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(Nos. I. to IV.—1883: with 23 Plates.)

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THE PHILOLOGICAL SECRETARY.

“It will flourish, if naturalists, chemists, antiquaries, philologists, and men of science in different parts of *Asia* will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease.” SIR WM. JONES.

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page	line	3	for	मार	read	मारै
"	24,	3	"	हा	"	हो
"	24,	23	"	भेजल	"	भेजले
"	24,	27	"	गोप्रुडवा	"	गोप्रुडवा
"	24,	36	"	खिण्वाँ	"	खिण्वाँ
"	25,	9	"	चिह्नै	"	चिह्नै
"	25,	12	"	but the	"	but with
"	25,	33	"	though	"	thou
"	25,	38	"	चिन्हैलौ	"	चिन्हैलौ
"	26,	26	"	मोरे	"	मोरे
"	26,	35	"	कर	"	करे
"	28,	17	"	ओग	"	ओगै
"	28,	24	"	दबु	"	दबु
"	30,	29	"	घहिर	"	पहिरा
"	31,	1	"	आचर	"	आचर
"	81,		"	hazráh	"	huzrá
"	82,		"	Gangar	"	Gandgar
"	83,		"	Mársir	"	Máhsir
"	89,		"	bhangh	"	báugh
"	124,	1	"	कुरिए	"	कुरिए
"	124,	20	"	कथे	"	कथे
"	125,	27	"	भाखति	"	भाखति
"	126,	28	"	ए	"	एँ
"	148,	37	"	जे	"	जेँ
"	150,	32	"	देखव, देखवै	"	देखव, देखवै
"	153,	30	"	घोडखड	"	घोडखड
"	157,	16	"	लिख	"	लिख
"	158,	14	"	देखि	"	देखि
"	160,	1	"	पावै	"	पावै
"	160,	20	"	मज्जै	"	मज्जै
"	161,	7	"	thee	"	those
"	163,	19	"	सप्तमै	"	सप्तमै
"	163,	23	"	or ए	"	or एँ
"	163,	37	"	151	"	154
"	211,	} <i>passim</i>		Mahmúd	"	Mahmúd
"	212,				"	
"	219,	25	transfer السلطان to the end of the legend.			

JOURNAL

OF THE

ASIATIC SOCIETY OF BENGAL.



Part I.—HISTORY, LITERATURE, &c.

No. I.—1884.

An Examination of the Trade Dialect of the Naqqásh or painters on papier-maché in the Panjáb and Kashmír.—By CAPT. R. C. TEMPLE, B. S. C., F. R. G. S., M. R. A. S., &c.

In the Selections from the Records of the Panjáb Government, Section I, 1882, are some *Linguistic Fragments* by Dr. Leitner. Among these “fragments” at p. xviii, are some words and phrases, used by the Naqqásh or papier-maché painters of the Panjáb and Kashmír as a trade dialect or *argót*, and also at pp. 2 & 3 of the Appendix is a long list of numerals used by the shawl-weavers of Kashmír and the Panjáb.

The list of Naqqásh words is not very long and as they will all undergo examination in the course of this paper, I give them here in full, taking no further liberties with them than to re-arrange them to suit my remarks.

Dialect of the Naqqásh at p. xvii. of Leitner’s “*Linguistic Fragments*.”*

Numerals.

1 ékam.	9 athwatir ékam.
2 hándish.	10 zu-atiláq.
3 yéndir.	15 tre-atalaq.
4 tzownter.	20 tzòr-átalaq.
5 atiláq.	25 páu-dùkh.
6 shánk.	50 odh-dùkh.
7 shánk ékam.	100 dùkh.
8 hásh berik; athwotúr.	

* The transliteration is Dr. Leitner’s.

General Nouns.

master, lánka.
 wood, hîma.
 house, shop, pánzir.
 word, náí.
 painting, téll.
 salt, tókkun.
 sugar, tokuwùn.
 tea, zal.
 tobacco, panyúl.
hugqa, panyúl-dotsh.
 paper, rikkîn.
 mouth, lâûr.
 eye, zû-tiûn.
qalamdân, zâkkir.
 rice, gúnne.
 bread, bérétz.

disease, máshilád.
 physician, nabzuwól.
 man, dohun.
 woman, woín.
 mother, bajûr.
 father, old, dóddur.
 daughter, putz-kât.
 son, pûtze.
 thief, poshumut.
 colour, riûg.
 night, krishor.
 day, zâdd, zârr.
 stomach, gúnna.
 water, zal.
 jewelry, dijjhlûl.
 hair, kiôpush.

Verbs.

be silent, mûnu.
 to see, natzun.
 see, natzo.
 to bear, wendun.
 hear, wêndo, wendûs.
 to die, be ill, máshiran.

to say, ask, párun.
 to be, zâddûn.
 to go, sandûn.
 to take away, sorwû.
 to sing, bomburûn.

Coins.

rupee, gash.

|. *paísá*, bôt.

Adjectives.

sweet, tokuwùn.
 little, cheap, kîs.
 much, dear, grûtz.

| good, sodd.
 bad, nâzz.
 ill, mashilad.

I had in 1882 an opportunity of testing at first hand, though on a small scale, both the above list of words and the shawl-weavers numerals given by Dr. Leitner, and I found them to be in the main correctly recorded, *i. e.*, according to my own ear, if I rightly read his somewhat puzzling transliterations. I should, however, like to make a few remarks and additions.

The Naqqâsh I examined were Kashmîrîs, but Dr. Leitner's were apparently Panjâbîs.

The Naqqâsh words especially tested by me are given in the following list:*

* In this list Dr. Leitner's words are according to his own transliteration, mine are given in that adopted by the Society.

Naqqásh words.

Leitner.	Temple.
house, pánzir.	pánzir, lir.
be silent, munn (and baguwín, milk, <i>sic.</i>)	mún.
salt, tókkun.	tókkun, tókawan.
sugar, tokwún.	• tókkun, tókawan, tókuwun, (ba- guwún, sweet).
paper, rikkín.	rikkín.
rupee, gásh.	gásh, gás.
good, sodd.	sodd.
bad, nätz.	náz.
to go, sandún.	sandún
go	sand.
man, dohun.	dúh.
woman, woín.	kollai.
mother, bajür.	møzh.
daughter, putz-kát.	putsakut.
son, pútze.	pútsa.
thief, poshumut.	póshumut, wasagun.

It will be observed from the above list that the words agree practically throughout.

Lir, ghar and pánzir were given me as alternatives for house, the *ñ* in the last word being a distinct and strong cerebral nasal, and the *r* of *lir* being also strongly cerebral. I heard the cerebral *ñ* again in *mún*, "be silent," and perhaps Dr. Leitner means his *mun* to represent a hard or cerebral sound.

Dr. Leitner gives the imperative as ending in *a*, e. g., *natzo*, see thou; *wéndo*, hear thou, (but also *wendüs*, regarding which see below). However, as far as I could make out, the imperative is the plain stem. Thus, *sandún*, to go, *sand*, go; *walún*, to come, *wal*, come. The instances at hand altogether are so few, and my attempts to get sentences, as I will show hereafter, so unsuccessful, that nothing can really be said as to what the imperative is.

Dr. Leitner uses all three accents á à â over his vowels and it is hard to say therefore what the force of each is in the absence of an explanatory note. The difference, therefore, observable between his vowels and mine may be merely graphic and not real.

In three words I could not get the Naqqásh to give Dr. Leitner's forms, *via*, for "man, woman and mother." Also the words for salt, sugar and sweet present a very remarkable peculiarity. It will be ob-

served from the lists above given that they are practically *the same*! After considerable enquiry all I could elicit from the men was that the words *were* the same, and that the sense depended on the context! Lastly, under “be silent,” and apparently by mistake, Dr. Leitner has given “baguwùn (milk).” This word, as far as I could make out, is a synonym for “sweet.”

I would also observe that the marked cerebralization of the vowel sounds makes it very hard to record the dialect as it falls on the ear. The same is observable in dialectic Panjábí, e. g., the first *á* in *áaná*, *gáhná* and the *a* in *banhá*. Dr. Leitner’s *putz-kät* and my *putsakut*, daughter, is a particularly difficult word to express, owing to the closeness of the vowels, which is such as one hears in the Pashto about Quetta and the Pishir. The final vowel in *pütze* or *pütsa*, son, is the final German vanishing *e*, which is, and is not, heard. As regards this, I think there is no doubt, that in order to record a dialect such as this properly, one ought to come to it prepared with a carefully selected set of vowel equivalents, or one will fail to give the living force of it.

To pass on to sentences. I made a short list of such sentences as are usual when testing a dialect or new language, in order to find out the forms of the tenses, &c., and began to run down it, but the result was not satisfactory, and after seven of them had been gone through, the Naqqásh were either tired or sulky, for they said it was “a sin to talk anything but *sîdhâ bât* (*sir*)” and would give me no more words or sentences. I accidentally elicited that they do not talk their peculiar dialect, but “*sîdhâ bât*” to their women. Here are some of my sentences.

Go quickly, *loghar loghar* (*لغز*) sand.

Go slowly, *sechir sechir* sand, *lot lot gás*.

These are natural enough, but the next upsets all testing of the verb “to go.”

• Go there, *dahinishnish*.

• Now for the verb “to come”; we have—

Come quickly, *jal jal wal*.

Come slowly, *lot lot wal*.

• And then again one is fairly taken aback by such a sentence as the following :

• Come here, *ái sapan*.

There is only one more sentence and that is a doubtful one.

Make this, *kom kar* (? for the Hindí *kám kar*).

There is a difficulty always present in such attempts, viz., that the examinee will always try and palm off Kashmírá or Panjábí words on you as those of his own dialect: will insist, in fact, on talking “*sîdhâ bât*.”

Now the question is, are these Naqqásh words part of a *bona fide* dialect, some relic of a past language in Northern India, or are they merely an *argót*, a more or less conscious formation of words for the purposes of secrecy? I think the answer will eventually be, when there are more *data* than at present available to go upon, that the bulk of the words are really dialectic and traceable to surrounding idioms, or to the former stages of the modern Aryan languages, but that in some cases words have been inverted and nonsense syllables prefixed or affixed in order to hide their true form. *B. g.*, náth=thán, place; gaukhá=gazkhá=kághaz, paper; (pu)-chhá-(rí)=chha, six, and so on. Such methods are no more uncommon in India than among thieves, bad characters, and children in Europe.*

There is only one way of ascertaining the answer to the question above propounded, and that is, by comparison of the Naqqásh trade dialect with such others as are available and with the surrounding idioms and ancient tongues of Northern India. The dialects at present available to me are the Naqqásh, the Zargarí of Kashmír, the Zargarí of the Panjáb, the Zargarí of the North West Provinces, the dialect of the carpenters, blacksmiths and masons of Kashmír, of the shawl-weavers of the Panjáb and Kashmír, of the so-called Khurásání Magadds, and of the Changars. The languages I propose to compare the above with are Kashmíri, Panjábí, Hindí, Prákrit and Sanskrit, and secondarily with Persian and Arabic.

The authorities consulted for the words in the comparative tables given in this paper are—

Dr. Leitner, *Linguistic Fragments*, 1882, pp. v-vii, xvi-xviii, and xxi, appendix pp. 2 and 3. *Sketch of the Changars*, 1880, p. 12.

Elliot, *Races of the North West Provinces*, Beames's Ed., 1869, vol. i, pp. 160-1 and footnote by Beames.

Lodiání Panjábí Grammar, 1854, p. 82.

• Kellogg, *Hindí Grammar*, pp. 94-108.

Platt, *Hindústání Grammar*, pp. 49-50, and foot notes, 85-6 and 112.

Whitney, *Sanskrit Grammar*, §§ 475-89.

All the above names of tribes and trades speak for themselves excepting the Khurásání Magadds and the Changars. The former were a band of foreigners, who infested the Panjáb in 1868-72, and who said they were Khokándís or Persians, but Dr. Leitner (p. xii.) seems to think they were Persian Gypsies with a long residence in India. The latter are a humble tribe, harmless enough in their way, to be found

* See Appendix to Dr. Leitner's *Analysis of 'Abdu'l-Ghafúr's Dictionary*, 1880, p. xviii, and his *Linguistic Fragments*, pp. xiv, xv.

performing lowly occupations, in several parts of the Panjáb. They have a real dialect or language of their own.

For the purposes of comparison, and for noting the results that such may show, I select the numerals first, as being the easiest to trace, the most likely to be found complete in all dialects, the least liable to inflection and, excepting perhaps the pronouns, the most persistent words in all languages.

The following is a comparative table of the numerals in all the dialects and languages mentioned above.

(See Table I, next page.)

In order to sift the words in these tables, those which are compounds of each other and also those which, though used for numerals, are really foreign to any numerical system must be first eliminated. All such words are shown in italics in the tables. They commence at the number 5. Thus—

5. atiláq hatlaq, attiláng, lámman, all mean the hand, the “ bunch of fives.” kanzün = half-ten.

6. kanzün-te-bin is half-ten + one = 6.

7. shánk-ékam is 6 + 1; kanzün-te-handish is half ten + two = 7; lámman-aur-sanní is 5 + 2 = 7.

8. kanzün-te-yindir is half ten + three = 8; bōd-tsor is twice four = 8; and lámman-aur trewái is 5 + 3 = 8.

9. athwatir-ékam is 8 + 1 = 9; bin-kam-zün is one less ten = 9.

10. bōd-attiláng is twice five = 10; do-lamman is twice five = 10.

15. tre-ataláq is three times five = 15; dod-zün is $1\frac{1}{2}$ times ten = 15.

20. tsor-ataláq is four times five = 20; ha-zün is twice ten = 20.

25. paú-dúkh is one quarter hundred = 25; daí-zün is $2\frac{1}{2}$ times ten = 25; ha-zün-te-ataláq is twice ten + five = 25; ha-zün-te-kan-zün is twice ten + half ten = 25.

50. oḍh-dúkh is half a hundred = 50; rúm-do is five times ten (? ten times five) = 50; kan-wát is half a hundred = 50; tál-sér is half a hundred = 50; pándo-lísa is five twenties = 100.

100 sér is 100 as being the old ser of 100 tolas.*

The elimination of these leaves us only *bonā fide* numerals, whether separate words or compounds, to deal with. Of these a large number in all the trade dialects are directly connected and descended from Prákrit and Sanskrit, and it is to be noted how persistently the Sanskrit termination *an* occurs. But it must be admitted that a considerable residue still remains which defies classification.

* The ser in now 84 tolas.

TABLE I.—Cardinals.

Numerals.	Naqqāshl.	Zargari Kashmiri.	Tarkhān, &c. Kashmiri.	Shāhsāz Kashmiri.	Zargari Panjabl.	Hindustānī.	Kinurāsānī Magaddl.	Changari.	Kashmiri.	Panjabl.*	Hindi dia- lects.	Prakrit.	Sanskrit.	Persian.	Arabic.
1	lékam	bin, hább	ák, ních	nal, nalas	akára	mánu	ekátt†	ek	ák	ikk	ek, ik, yek, ekka, ekam, kam, ekna, kan	•	eka	yak	abad, wáhid, ihda, wáhidā, ímān, sínān.
2	hándish	handish, handish	wíng	don	sanní	saunán	doátt	tór, torá, zú, tórat	zih do, tá	ká	dowai, do dwan, dúj, dúná, dú, doh, don	•	dwi	du	wáhidā, ímān, sínān.
3	yéndir	yandir, yindir.	wurún	trin	trewái	ekwái	seátt	teg, tegá, tregat	tre	trai	tini, triyá, tinni, tuj, títinā, tí, tih.	•	tri	sih	salása, salás.
4	tsauntar	kár	tyor, ser san	san	airan	ahirin	chrátt	chang, changá	tsó*	chár	chár, chá, chatiári, rik, chau, chaukú	•	chatur	chubár, at'ba'.	salása, salás.
5	atildáq, hatlaq	rúm, kanzún	atildáng	phantian	lámman	pálo	panjatt	pándo	pánts	panj	panje	•	panchan	panj	khamas.
6	shánk	kha, kan- zún-te-bín.	shúpp	shin	chélí	puchhári	shesbátt	chóblu	che	chhe	chhah, chhath, chhakka	•	shash	shash	sitt.
7	shánk-ekam	phál, kan- zún-te-han- dish	.....	sáthan	lámman-aur-san- ni	paint	hafátt	satélu	sát	satt	satte, sat	•	saptan	haft	saba'.

* In the Panjabí and Hindi Dialects columns, words are included other than cardinal numbers, because what may be now an ordinal or multiplicative form in them, may have a common derivation with the cardinals of the trade dialects. Transliterations have been made uniform for purposes of comparison.

† átt = ? hátt = ? háth, hand.

TABLE I.—*Cardinals.*—(Contd.)

Numerals.	Nagasaki.	Zargari Kashmiri.	Tarkhan, &c. Kashmiri.	Shahbaz Kashmiri.	Zargari Panjabl.	Zargari Hindustani.	Khurasani Magadhi.	Changari.	Kashmiri.	Panjabl.*	Hindi dialects.*	Prékrit.	Sanskrit.	Persian.	Arabic.
8	shásht berik, zūn-te-yin-athwatur dir	mánz, kan-zūn-te-yin-athwatur dir	.....	áthan	lámman-aur-tre-wól	karhá	hashátt	atélú	át	atth	atthe	attha	ashtan	hasht	samání
9	athwatur-wán, bin-ekam	wán, bin-kam-zūn	.....	nan	lámman-aur-av-	korág	noátt, noik	natélú	nan	nan, náún	nawá, ná, nam-má, nam-má	na-ava	navan	nuh	tise'
10	za-atidag kirr, zūn	kirr, zūn	ból-atti-lázg	dahan	do-lámman	águr	deik	dasélú	dah	das, dharí	dah, dahám dasa	pannara-ha	dasan	dah	'ashr.
15	tre-ata-lag	dód-zūn	.....	panda-han	.....	.....	.....	parélú	.....	pandrá	pandrá	pannara-ha	pancha-dasap	panz-dah	Not in ordinary use in India.
20	tsór-ata-lag	phút, ha-zūn	.....	wohan	sútri	sút	bisik	lí, lisa	wú, wih	bíh, víh bis	.....	.....	pancha-viasati	bist	.....
25	pán-dákhi-dái-zūn, ha-zūn te ari-lag, ha-zūn	zūn te ari-lag, ha-zūn	.....	panso-han	.....	.....	.....	.....	.....	panj, pachí	.....	.....	pancha-viasati	.....	.....
50	qāh-dákhi-rám-do, kan-gat	te-kan-zūn	.....	pantsha-hin	tól sér	.....	.....	.....	pánsha	panjáh	pachás	painnasa	panchá-sat	panjáh	Not in ordinary use in India.
100	dúth	yikam, wát	.....	hát	sér	bhdá	sadik	ner, pándo-lisa	hát	sai, saikrá sau.	sai, sai, saikrá sat, saikrá sau.	saa	sáta	sad	.....

* In the Panjabl and Hindi Dialects columns, words are included other than cardinal numbers, because what may be now an ordinal or multiplicative form in them, may have a common derivation with the cardinals of the trade dialects. Transliterations have been made uniform for purposes of comparison.

TABLE II.—Multiplicatives.

Naqqáshí.	Zargari Kashmirí.	Tarkhán, etc. Kashmirí.	Shálsáz Kashmirí.	Zargari Panjábí.	Panjábí.*	Hindí dialects.*	Prákrit.	Sanskrit.
$\frac{1}{2}$ páú	.....	.....	pan, panas	.....	pau, chuthái	páo, chauthái	.....	páda.
$\frac{1}{3}$ oñh	kan, dandan	.....	.....	tái	addh, addhá	ádh, ádhá	.....	arddha.
$1\frac{1}{2}$	dod	.....	dod	do	deph	deph, dúrphá, georhá	divaddhe	dwivarddha.
2 za	ha	bod	don	.....	dúni	dúná	.....	dwis.
$2\frac{1}{2}$	daí	.....	dayan	.....	dáá, dhái	arhá, aḥhá	.....	(?) trayárdhatt
3 tre	.....	.....	tini	.....	tráun	tí, tíná	.....	tris.
4 tsor	.....	.....	san	.....	chauká	chauká	.....	chatus.
10 do	.....	.....	daban	.....	dálá, daháká, daháká	dahám	.....	.....

* The same note applies as to the former table.

† [The Sanskrit equivalent is *ardha-tritiya*, Prákrit *ardhá*, see Dr. Hoernle's Gaudian Grammar, p. 270. Ed.]

Words which are connected or are Prákrit and Sanskrit derivatives are as follows :—

Cardinals.

1. ék-am, ák, ak-ára, ikk, ek, ek-ka, ek-átt.
2. do-n, zü, zi-h, (*Dard* ju), do, du-j, dwi, do-att, to-r.
(ii) ha-ndish, sa-nní, saú-nán, (?) zü.
(iii.) dwi, (?) wí-ng.
3. ti-a, tre-wái, tre, ti-nn, traí, tí, te-g, tí-n, ti-nní, tri.^e
4. tsau-nter, kárr, tsor, chr-átt, chau-g, ser; 'chár, chár-i, chau, chattári, chatúr.
(ii) sa-n, (?) chau.
(iii) ser, (?) air-an, abir-in.
5. plānt-ian, pán-do, (?) pá-lo, pants, panj, panj-e, panj-átt, panch-a, panch-an.
6. shá-uk, kha, (?) shu-pp, shi-n, che-lí, che-blú, (?) pu-chhá-rí, che, chhe, chhah, chha, shash, shesh-átt.
7. sáth-an, sát, satt, satt-e, sat-élu, sat, satta, sapt-an.
8. (?) hást-(berík), ath-wotur, ath-watir, hash-átt, áth-an, át, atth, atth-e, at-élu, attha, asht-an.
9. naw-an, nau, náú-n, naw-á, no-átt, no-ík, nava, nav-an, na-rélu.
10. zü-n, dah-an, dah, das, de-ík, das-élu, das-a, das-an.
15. pan-dahan, pan-drá, pan-ñaraha, pancha-ñasan, par-élu.
20. woh-an, wú, bíh, víh, bis, bis-ík, vís-a, vinś-ati, (?) lí, lí-sa.
(ii) sūt-ri, sūt, (ví) saí, (vin) sati.
25. pans-oh-an, panj-í, pach-í, pach-vís, pancha-vinśati.
50. pants-abin, pán-sa, panj-áh, pach-ás, pan-ñasa, panchá-sat.
100. (?) wát, hát, hátt, sai, san, sal, sat, sad-ík, saa, śata.
(ii) (?) dú-kh, (*Dard* dosh-um), sad-ík, sai-krá, (?) yík-am.

Multiplicatives.

- $\frac{1}{4}$ tsáú, pá-n, pa-n-as, pan, páo, pá-da.
- $\frac{1}{2}$ oḍh, addh, ádh, arddha.
- $1\frac{1}{2}$ dod, doḍ, do, ḍerh, ḍeorha, divaddhe, dwiaddha.
- 2 (?) za, do-n, dú-ní, dú-ná, dvis.
(ii) za, (?) ha.
- $2\frac{1}{2}$ daí, da-yan, dá-ia, a-rhá-í, (?) tra-yárdha.
- 3 tre, ti-ní, trá-ún, tí, tí-ná, trís.
- 4 tsór, chau-ká, chatus.
(ii) sa-n, chau-ká.
- 10 do, dah-an, dáh-á, dah-ám.

Words apparently untraceable and worthy of further examination are —

Cardinals.

- 1 bi-n; habb; nal, nal-as; má-nú. But with bin compare the Dard hin.
 3 yé-ndir, ya-ndir, yi-ndir; wur-ún; ek-wái; se-átt.
 5 rúm.
 7 phál; paint, haf-átt. (paint is used by the Dehli daláls or touts).
 8 manz; karhá.
 9 (?) wán; kor-ág (P) for kam-águr, one less ten).
 10 kirs, águr.
 100 ner.

Multiplicatives.

$\frac{1}{2}$ tál; kan, (but kam = kan, for once, in Hindí).

2 bōd.

I have given Persian and Arabic numerals as usually used (when employed at all) in India, as of course slang and trade dialects would be quite impartial in their adaptations and would take in any word that would suit. The Persian numerals are so close to the Sānskrit and Indian that their influence may be set aside, except perhaps in two instances in the Changar Dialect, viz.:—

3 se-átt.

7 haf-átt.

Arabic influence may be visible in—

2 ha-ndish, (Naqqāshí and Zargarí Kashmírí); sa-uní and sau-nán (Zargarí Panjábí and Hindústání).*

9 kor-ág (Zargarí Hindústání).

10 águr (Zargarí Hindústání).

Some words, as sūt-ri and sūt for 20 in Zargarí Panjábí and Hindústání, seem to be relics of the last portion of the old Sānskrit and Prākrit compounds vin-sati and ví-sa, just as wo-h-an, wú, bí-h, ví-h, bí-s, would be relics chiefly of the first portion only. Perhaps wán, 9, Zargarí Kashmírí is the same unless it be simply nau reversed.†

Guided by the *ik* terminations for tens in the so-called Khurásání Magaddí we may perhaps see something of the sort in yik-am, 100, Zargarí Kashmírí; thus, śata, sad-ik, sai-krá, dú-kh, yik-am.

Although the above identifications seem satisfactory on the whole, and the words unaccounted for are few, still the terminations of the words remain in an unsatisfactory state.

* Swán is used by the Dehli daláls or touts for 2, a corruption there apparently of the proper name Sohan.

† Wán is the word used by the Dehli daláls. Fallon in his *New Hindústání Dictionary* gives a quantity of these numerals as those of brokers, dealers, etc. They are scattered about the pages and very difficult to collect, but it would be probably worth while doing so and examining them.

It is not difficult to see the relics of the old Sanskrit *an* in the following:*

- 1 ek-am, (?) bi-n.
- 2 wí-ng, dó-n, (?) sa-nni, (?) sau-náu.
- 3 wur-ún, tri-n, (?) te-g.
- 4 sa-n, air-an, ahir-in, (?) chau-g, (?) chau-ga.
- 5 phanti-an.
- 6 shá-nk, shi-n.
- 7 sáth-an.
- 8 áth-an.
- 9 (?) wá-n, naw-an.
- 10 zii-n, dah-an.
- 15 pañdah-an.
- 20 woh-an.
- 25 pansoh-an.
- 50 pantsah-in.
- $\frac{1}{4}$ pa-n.
- $\frac{1}{2}$ (?) ka-n.
- 2 do-n.
- $2\frac{1}{2}$ day-an.
- 4 sa-n.
- 10 dah-an.

We may perhaps see *śati* in *li-sa*, 20, *Changarí*, and the *últ* termination in the *Khurásání* may be explained to be *háth*, hand.

But the majority of the terminations seem to be untraceable, especially the remarkable ones of the *Naqqáshí*, viz., *ha-ndish*, *yó-ndir*, *tsauntar*, *ath-wotar*, *ath-watir*. *Ya-ndir*, *yi-ndir* occur, too, in the *Zargarí* *Kashmírí*. Taking *wotar* and *watir* into consideration and dropping the *n* of the others as phonetic, we get *dish*, *dir*, *ter*, *wotar*, *watir* for the true terminations. These are comparable with the idiomatic *utar* and *otar* of *Hindí*.† With *handish* may be compared the Tibetan *nish*, 2.

In *Naqqáshí* occurs *hásht-berík* for 8, with which may be compared the *Khurásání* numerals.

Besides the above we have, and all apparently untraceable terminations,

* [This is very improbable. *Dón 2*, *trin 3* correspond to the *Prákrit doni, tinni* (Skr. *triṇi*) with the neut. plur. termination *ni*.—The *wotar*, *watir* is the Skr. *uttara*; thus *athwatar-ékam 9* would be Skr. *ashṭottaraikam* “one added to eight,” whence by a not uncommon mistake *athwatar* (‘added to eight’) is taken to mean ‘eight’! Similarly in the case of *tsauntar*. Ed.]

† Kellogg § 184 (a), p. 166. Platt, 51, footnote.

1 nal-as, ak-ára.	8 at-élu.
2 tó-r, to-ra, to-rat.	9 no-ík, na-rélu.
3 tre-wái, ek-wái.	10 de-ík, das-élu.
5 pá-lo, pán-do.	15 par-élu.
6 shu-pp, che-lí, puchhár-rí, che- blu.	20 bis-ík.
7 sat-élu.	100 sad-ík.
	$\frac{1}{4}$ pa-n-as.

The *pu* in *pu-chhá-rí*, 6, perhaps purposely inserted for secrecy, is a curious and notable prefix. It occurs again in the Zargarí Hindústání as *pu-chhá-rihá*, half a pice, but apparently really meaning one-sixth.

The compound numerals show how clearly these dialects borrow from the surrounding idioms for their expressions. The conjunction in the following is pure Panjábí, meaning *and*.

6 *kanzün-te-bin*.

7 *kanzün-te-handish*.

8 *kanzün-te-yindir*.

25 *hazün-te-atilaq*, *hazün-te-kanzün*.

In the following the same conjunction is pure Hindí.

7 *lámman-aur-sauní*.

8 *lámman-aur-trewái*.

9 *lámman-aur-airan*.

• So, too, we have pure Hindí.

9 *bin-kam-zün*, one less ten.

Lastly, the principles on which the following compounds are constructed will be at once recognized as ordinarily current in the modern Aryan languages of India.

15 *dód-zün*, 1½ times ten.

25 *paú-dúkh*, $\frac{1}{4}$ hundred; *daí-zün*, 2½ times ten.

50 *odh-dúkh*, half hundred; *kan-wát*, half hundred, *tál-sér*, half hundred.

There remains but one word to notice, *dandan*, half, Zargarí-Panjábí, which may be an inversion of *ádth*, a common trick in the slang of traders and bad characters.

I therefore think that the numerals raise a strong presumption in favour of considering these dialects to be real dialects and relics of a by-gone speech, or form, of speech as opposed to mere slang.

Let us now turn to the other words given by Dr. Leitner and compare them. Unfortunately they are not numerous and complete enough to satisfactorily upset or confirm the conclusions the study of the numerals would lead us to. But an examination of them is very encouraging, as the majority succumb under comparison with existing idioms and languages, and prove themselves to be either relics or adaptations of

known words. Moreover the same form of words, whether derivable from Prākṛit, Sanskrit, Persian or surrounding idioms or not, is found to exist in the dialect of traders widely separated geographically. Thus, the words for "eye," clearly traceable to existing words, are the same practically among the Naqqāsh, Panjābī Zargars, Kashmirī carpenters, &c., and the Changars. In the Kashmirī and Hindústānī Zargarī no word is available, and in the so-called Khurāsānī it is *nūr*, a clear borrowing from Persian. The coincidence and similarity of the words in the Changarī, Naqqāshī and Zargarī Panjābī dialects can hardly be accidental. It points to a common derivation from some old and forgotten forms of the existing recognized dialectic words.

The following table contains the comparison of 55 words and expressions in all the above dialects.

(See Table III, next page.)

As in the case of the numerals let us commence sifting this table by eliminating from it categorically all borrowings from surrounding idioms. All such are printed in italics in the table. The following words are derivable more or less directly from words in actual use in ancient or modern languages or dialects.

General nouns.

master; *lānkā* is Kashmirī: for *bāk*, *teg*, *tog*, *tagīs* see "man."
wood; *hímá*, is Persian, *hezam*: *lichkrī* = *lakrī*, Hindī.

house, shop; *pánzir* is (?) Pers., *pázer*, in possession: *lir*, is Kashmirī:

hattī = Panj. *hattī*, a shop: *pír-khána* is Pers., a holy man's house and is here ordinary slang: *nád* = *naḍ*, Panj. Hills, a riverside cave; it may also be *thán*, place, reversed. See Beames' note to Elliot, i,

161.

paint, oil; *tēl* = Hindī, *tel*, oil: *kiób* = Panj. *ghio* = Kashm. *ghíáu*, *ghí*:

kajálná, Dr. Leitner says this is for *ka* + *jalná*, to burn, but may it not be for *kájal*, lamp-black used as paint for the eyebrows?

word; *nái* is Panj. Hills for "word."

salt, sweet; *kaurmá*, salt, = Panj. *kaurá*, bitter: *mitmí*, sweet, = Panj.

mitthá; for the Panj. terminations *má*, *mí*, see Sirdár Gurdíál Singh's (C. S.) remarks in Dr. Leitner's *Sketch of the Changars*, 1880, pp. 19—20.

tēa; *zal* is "water," *jal*: *chik*, *sakhí*, = (?) *chá* (which is of (?) Persian origin) + *khí* or *ká*, or perhaps they come from Panj. *chakhná*, to taste.

tobacco; *hasúká* = Hindī and Panj., a smoke, a dust: *phámphí* = Hindī and Panj. *bháph*, a vapour.

huqqa; *panyúl-doch*, *doch* is Panj. Hills for *deēhíkí*, the ordinary hubble-bubble; this inclines me to connect *panyúl* with *piná* or *pání*.

TABLE III.—General Nouns.*

English.	Naqqāshī.	Zargarī Kashmirī.	Zargarī Panjabī.	Tarkhān, etc., Kashmirī.	Zargarī Hindustānī.	Khurāsānī Magaddī.	Changarī.
master	lānākā	bāk (= man)	.....	teg, tog, tagīs (= also great)	math	.....	.....
wood	hāmā	.....	.....	kesur	.....	.....	lichkrē.
house, shop.	pānzir, lir	nelahan (shop)	nel; hattī, pīr- khāna (shop)	.....	.....	dile	nād
paint, oil	tāl	.....	.....	kiōb (oil & ghī)	nānwikāhā	.....	kajālānā.
word	nāl	.....	.....	.....	.....	.....	.....
salt, sugar	tokkūn, tokwūn	.....	.....	.....	rāresikā (salt)	.....	kaurmā (salt)
tea	zāl (? water)	chik	.....	sakhī	.....	.....	mītmī (sweet)
tobacco	panyūl	.....	.....	panyūl; panyil (snuff)	bhasūkā, phāmphī	.....	.....
huqqa	panyūl-dōch	.....	.....	.....	.....	.....	.....
paper	rikkin	.....	.....	.....	gauhā	.....	.....
mouth	mūr	.....	bās	mēch (face)	bhās	yakāk	kumbr (?), bra- tiri.
eye	zū-tūn, zi-tinī, (zū = two)	.....	teg	zū-tinī, tinge	.....	nūr	pa-tirmā, pa-chirmā.
qalamdān	zākkir	.....	.....	.....	.....	.....	.....
rice	gūnne, xād	rāng	.....	rad	.....	parīst	kōndr.

TABLE III.—General Nouns.—(Continued.)

English.	Naqáshí.	Zargarí Kashmirí.	Zargarí Panjábí.	Tarkhán, etc., Kashmirí.	Zargarí Hindustání.	Khurásání Magaddí.	Changarí.
bread	bérets	atich, nang	neg, nígle	.....	tápne	yarthit	tapl.
disease	máshildá	.....	.....	.....	.....	.....	.....
physician	nabzuwól	.....	.....	.....	.....	.....	.....
man	dohun, dúh	bák, bóke	gelá	toj, tagts	.....	mák	gáun.
woman	woin, kollai	kinn	sian	uány, wón	berof	nadán	grání.
mother	bajúr	zohó kinn (great woman)	.....	bájú	thenthí (old)	mánk	járf (also aunt)
father	dóddur (old)	.....	dóddúr (old)	láme	thórwóná (old man) thyáthá (father)	bánk, abelák (great)	járf (also uncle)
daughter	putsakut, putskát	.....	.....	.....	.....	dumtáz, dikhách	dibí
son	púse	.....	.....	.....	chúnwá	jáde, putr	diblá.
thief	poshumut, wásagun	chokendás	.....	wúise	koiú ; kodí (theft)	gínán	kóder.
night	krishor	.....	.....	.....	.....	.....	nela, channan.
day	zád zár	.....	.....	zarin wát	.....	.....	temkaná.
stomach	gúnná	.....	.....	.....	nadikh	.....	ádh, deddo.
jewelry	dijphál	dorí, zúl	.....	dóijphál	.....	.....	.....

TABLE III.—General Nouns.—(Concluded.)

English.	Naqqáshí.	Zargari Kashmiri.	Zargari Panjabí.	Tarkhán, etc., Kashmiri.	Zargari Hindustaní.	Khurásaní Magaddí.	Changari.
hair	kiópush	.....	.....	kane-ke-shupp	.....	.....	vól.
hand	hatlaq	lámá	lámman	tseñ-horr	hathan	Khátt, át	.....
colour	rióg	.....	.....	.....	.....	.....	.....
waters	zal	.....	áb, jal	zát	nájna	mayáo	nér.
Verbs.							
be silent	múnn, múñ	.....	.....	.....	níthe hóhú	.....	.....
to see	natsún	.....	.....	.....	lau karat hai (he sees)	.....	.....
see	natso	.....	tigdá (he sees)	.....	láo karan (see)	.....	hok lé.
to hear	wendún	.....	.....	.....	.....	.....	.....
hear	wendo, wendús	.....	.....	.....	.....	nér bedá	sung lo.
to die, be ill	máshiran	.....	.....	.....	.....	.....	.....
to say, ask	párún	.....	.....	páriús (ask)	dámisáhu (speak)	.....	.....
to be	zaddún	.....	.....	ches, chu, (is)	.....	.....	.....
to go	sandún ; sand (go)	rusún (to go) ; torús (go) ; toroo (went)	búrt, búrt, vát, (go)	sir (go), vátin	.....	obam (I am), oba (is) búkm, (go)	jáo kur (go).

TABLE III.—*Verbs*.—(Concluded.)

English.	Naqáshí.	Zárgarí Kashmírí.	Zárgarí Panjábí.	Tarkhán, etc., Kashmírí.	Zárgarí Hinduráshí.	Khúrásání Magaddí.	Changarí.
to take	sorwún	.....	.....	sarewú (imp.)	.....	.....	seir jóo (imp.).
to away	bombárún	.....	.....	bomburún	biárho (sing)	.....	.....
to sing	hárún	.....	.....	.....	.....	.....	.....
to fall	walún	.....	búte á (come)	zireo (came)	.....	búars (come)	kur kunár (come).
to come	.....	.....	.....	.....	.....	.....	.....

Coins.							
rupee	gásh, gás	mánká, bin	ággu	gash	parikalá, bajná	.....	bereá.
silver	.....	bún; (mar, money)	ruggí	.....	sariya (1 pice)	peli, noqrá	.....
pice	láng	bót	láná	láng	.....	.....	másiá.
topper	.....	rúh	subh	.....	.....	.....	.....

Adjectives.							
sweet	bagawún, tokuwún	.....	hokí (little, also	daká, wartús,	.....	.....	.....
little, cheap	ks	kín, tám; zabár,	dear,	miáne (also half)	biagat (less)	káleh, galá,	licherá.
much, dear	grúta	bór (big), zóhó,	uggi (also cheap	grus	beáras (more)	kiánurs	labánk, ubelek,
		much	& see rupee)			(see father),	jerá.
good	sod	tsásle, chin, (also	sánchá	ai	.....	geni	do.
bad	náz	cheap)	.....	náz	káust	dakh, náto,	.....
ill	mashiláa	.....	.....	.....	.....	bntúp	.....
		.....	.....	.....	.....	wartúp	.....
		.....	.....	.....	.....	nakhás	.....

áyá merá Katoch,

píne baiṭhá hathen doch.

Kánggrá Proverb.

my friend the Katoch came and sat down to smoke with the hubble-bubble in his hands, *i. e.*, did the gentleman and was idle. Said of an idle useless person. The Katoch Rájpúts were the old ruling class in Kánggrá.

paper; rikín = Panj. Hills, likhín, paper: gaukhá = ghazká = kághaz; Beames' footnote to Elliot, i, 161.

mouth; face; múr = Hindí (Jhán sí) head: múch = muchh = mukh, the face; bús, bhús from bhús karná, Hindí, to masticate.

eye; zū-tūūn, zi-tiní, teg, zu-tingí, tinge, pa-tirní, pa-chirní and tig-dá, ho sees = Panj. Hills ṭiḍḍ, ṭiṇḍ, the eyeball and takná, to see; zū, zi, zu (and (?) pa) = Kashm. zū, zil, two; thus zūtūūn, ṭeṭe, would be the two eyeballs and so on, and pa-tir-ní (ṭiḍḍ) would also be the two eyes;

tere ṭiḍḍ jalen!

Kánggrá.

is a common abuse corresponding exactly to our own vulgar expression "blast your eyes."

núr = Pers. light.

ḡalamdán; zák kir = (as a guess) zákir from Arabic zikar.

rice; kóndr = Panj. kodrá, corn.

broad; bérets = barach, = charb (or chab) reversed, which in the Panj.

Hills, means any kind of food for a journey; chab is properly any parched grain for food: nang, neg, nígle = Panj. nigalná to swallow. disease; máshilád, máshiran, to die, mashilád, ill, = machilá, a malingerer; machal jáná is a Panj. idiom for to die, explained as (but?)

ma + chalná, to go away.

physician; nabzuwól = nabz-wálá, Panj. and Hindí.

man; bák, báke, mák and bák, master, háuk, father = háuká, Panj. a fine man: tog is gut or got (*but*), Panj. Hills, reversed, a body; thus,

main ne janaure dí gut jándí dikhí,

I saw an (animal's body) animal going along.

main jāndí dikhí gut,

jāne dhí thí, jāne put.

Kánggrá Proverb.

I saw a person going along, who knows whether male or female, *i. e.*, I saw some one in the distance, but could not distinguish who it was.

teg and tagís would come from tog.

woman; woin, wáñy, wán = Panj., bánj and Kash., wónj, a barren woman: kinn is (?) nik-í reversed, Panj., a small woman: sian = (?) hían, Panj. Hills, a brave woman; hía, courage; hiau, brave man; hiau, brave woman: beroi = (?) birví, (fem. of bír, brother,) Hindí, a female friend, sister.

mother; thenthí, mánk, járí, see "father."

father, old; dóddur, doddúr = dádá, grandfather, as also do probably thyáthá and thenthí (mother): tháwáná = Hindí (Jhánsí) dáu, old; járá, járí = jad, jadá, Pers. (from Arab.) a grandfather, grandmother; tsúdá, old, = súdá, old man, Panj. from (?) Pers. súdan, to rub away: mánk, bánk = (?) má-báp.

daughter; dilkhách = Pers. dilkash, a darling.

son; putse, putr = putr: chúnwá is Panj., a darling boy: ejáde = zádá, Pers.: putsakut, daughter may be for "small or inferior son"; cf. Kash. lakut, little.

thief; poshumut = pushmattá, Panj., a hider, thief: wusagun = subsagun *lit.*, a good omen, but used for a thief as a euphemism.

Aj uske ghar men subsagun gayá, aur usko nihál kar díá.

To-day a thief (*lit.*, good omen) came to his house and robbed everything (*lit.* made him very rich).

Subsagun áyá thá dar

Dhan rakhne ko kuchh thá na ghar. *Hindí Proverb.*

The thief (good omen) came to the door, and there was no need of keeping wealth in the house.

Chokendáz = (?) surákh-andáz, Pers., house-breaker: kotú is Panj. a house-scaler: kodí, theft, and koder = Panj. khodí, a house-breaker.

night; krisor and nelá would mean dark: channan = Kash. chungun, to lie down; the Tibetan word for night is also nichannan.

day; zarín-wát, zád, zár = zarrín, golden, bright, also (poet.) the sun, Pers.; zarín wát = (?) zarrín wáqt, and hence zád and zár: temkaná is Panj., tamkaná and damkaná, to shine.

stomach; didh, deddo are Panj., dhid; nadikh = doubtfully Panj. nadikh honá, to have a painless or easy labour; nadikh 'aurat, a fruitful woman or a woman descended from a fruitful stock.

jewelry; dijphúl, dájphúl = Panj. and Hind. dáj (= dahej = daheṛ) + phúl, the dower jewels: dorá, dell (*cf.* mera = mora, teg = tóg, doch = dechki) = Panj. Hills, the marriage hair ornament worn for six months after marriage = Panj. prándá.

hair; wál is Hindí bál and Panj. wál.

hand; hathná, át = háth.

water; áb; jal, zal, zál and nír speak for themselves.

Verbs.

be silent; múnn, muṇ = Hindí muní honá, to be dumb: níthe hohú = Urdú idiom niyat sa raho, be quiet.

to see, see; tigdá, see "eye": hok le = (?) dekh le, a mere corruption; *cf.* doch = dechki, merá = morá, etc.

to hear, hear; núr bedá = (?) Pers. núr bidár, *look here, listen* : sung lo is Hindí and Panj. sun lo.

to die, be ill; máshiran, see "disease."

to say, ask; párun, páriús = (?) ba-purs, Pers. ask!

to be; záddún is Pers. zadan, to be born.

to go, go; sandún, sand is Panj. handná : torús, tório are Panj. turpá : wát, wátú = Panj. Hills wátná, wutná, to go, (*cf.* bát, a road); wut wut! go along, come along is vulgar Panjábí and hence probably bút and (?) búrt in Pánjabí Zargarí : bikím = (?) Pers. bi-kam, grow less, diminish, vanish! : sír (*cf.* seir jáo, take away) = (?) Uṛṛú, sair karná, to make a journey : jáo kur is Hindí go!

to take away; sorwún, sarewiú may be. for chhorna and chhadná, Panj. to let go : seir jáo see "go (sír)."

to sing; bomburún = burná, Panj. to bubble : biárho = biár, a puff, rush of wind, sound of wind, Hind.

to fall; hárún = Panj. harná, (to take away, lose and) to fall (of water).

to come, come; buars = (?) bi-ras, Pers., arrive, come! wakún, *cf.* Kash., walyúr, come here!

Coins.

rupee; mánká = mánik, Hind. (manakya Sansk.), a precious stone; pari-kaliá is from (?) Hind. parkná, to test a coin : bajná is Hind. to test a coin.

silver; noqrá is Arabic in common use.

pice; máslá is Hind. a small pice.

copper; subh = sobhí, Hind. alloyed silver, base silver.

Adjectives.

little, cheap; kís = kuchh, kichh, Panj. and Hindí : kin = nik reversed

Panj., very little : daká is Arabic daqíqá, a little, in common use :

miáne is Hindí half; qalíl, kilel are pure Arabic, a little.

much, dear; bór is Hindí bará, Kash., bod, Panj. waqá.*

good; sod is Arab. sa'ad, good : sánchá is sánchá Panj. true : mító = mithá, sweet : chin = Kash. jwán.

bad, ill; nakhús = Arab. náqis, bad, whence (?) názz or náz : kánsí = kasná, Hind., to be made bad, i. e., by putting lime on to brass or copper vessels so as to make them poisonous : mashilád see "disease."

The major portion of the words are thus disposed of and shown to be really dialectic and not slang inventions. A further examination of the underived words will show that many of them are evidently connected

* To be noted here with regard to grúts, grús, much, dear; these are the Kash-mirí drúg, dear, surúg, cheap, reversed.

with each other, and that it is only a question of a minuter knowledge of idioms and languages than I possess to trace them to their origins. Thus,

General Nouns.

house, shop : nelahan, nel, dile.

tobacco, snuff : panyúl, panyil.

rice : rad, rád, ráng, pa-rást.

bread : a-tích, yar-thít, táp-na, tap-i.

man ; woman : gelá, gáun, girání.

mother : bajúr, bájú.

hair : kiöpush, kanekoshup (if shup = push).

hand : lámná, lamman.

Verbs.

to go ; take away : sir ; sorw-ún, sarew-iú, seir-jáo.

Coins.

rupee : gásh, gás, gash.

rupee, silver : bin, bün ; ággü, ruggí ; berea, peli.

pice : láng, láná.

Adjectives.

much : grúts, grús.

little ; great : licherá ; jerá.

good ; bad : bu-túp ; war-túp : (little) war-túts.

These leave but a small residue of isolated untraced words, which I give here so as to have them in one view for purposes of future comparison by myself or others, should opportunity arise.

General Nouns.

wood : kesur.

oil : nánwikáhá.

salt (also sweet, sugar) : tokkún, tokuwún.

sweet : baguwún.

month : yakák, kumbr, (?) bratirí.

qalamdán : zakkir, (but see under traced words).

rice : gúnne, (unless meant for sugarcane).

man : dohun, (dúh).

woman : kollai, nadáu, sían (but see under traced words).

father : láme.

daughter : diblí, putsakut (putskät), dumtáz. If puts = puchh, a tail, then dumtáz is a remarkable coincidence.

son : diblá.

thief : wútse, gináu.

stomach : gúnná (cf. "rice" above), nadikh, but see under traced words.

hand : hatlaq, tseñ-hor, khát.

colour : riúg (unless a corruption of rang).

water : nájná, mayáo.

Verbs.

to see : nats-ún : láo (karan).

to hear : wend-ún.

to say, ask : dâmis-âhú.

(he) is : ches, chú : (I) was, ob-um : (he) is, ob-e.

to go : rus-ún.

to come : wal-ún : búte (á) : (kur) kunár : (came) asp-eo, zir-ed.

Coins.

pice : lôt, saríyá (? means one-third).

copper : rúh.

Adjectives.

little, cheap : tem, hokí, bhagat, kiámus

cheap : zabár.

much : zöhü, beárás, ubelák.

good : tsásle, chin, ai, dakh, do.

I tried the untraced words with several Kashmiris, and residents of the Himálayan Districts and they told me they were Ladákí. I then searched in Cunningham's *Laduk*, 1854, who says, p. 397, that the language of Ladák is Tibetan, and at pp. 398—419 he gives a long comparative table of the following "Alpine Dialects" or Languages; Dard, (3 dialects) Páshto, Kashmíri, Sanskrit, Hindí, Panjábí, Gaddí (Kángará) Kulluhí (Kullú) Garhwálí and Tibetan (3 dialects). The help thus obtained was next to none. Thus,

master, man : teg, tog, tagís, might perhaps be Tibetan, tek, teg, good, (see my tables).

mother : bajúr, bájú, may be connected with Gaddí and Kulluhí, iji, and Garhwálí, bhaí.

night : channan is very like Tibetan nichanno, but see the word above. I am; he is : obum; obe are comparable with the Dard bé, to be; I am, ja bá; thou art, um bá; he is, ai bá.

The inferences then to draw from this examination would seem to be, that, though the special dialects of the Indian traders may now be looked upon as slang, and though they undoubtedly contain slang distortions and perversions of common words purposely made, the majority of their words are dialectic and *bona fide* represent either real existing words, or older, and in some cases obsolete, forms of them, and that they contain these words in sufficient quantities to render it worth while to study them as dialects.

Unfortunately, the materials for the dialect, which I have been led to examine are the most meagre of all those given by Dr. Leitner.

Much fuller materials for examination exist from his and Elliot's researches into the dialects of the Changars, the Zargars of the Panjāb, Kashmir and Hindústān proper, and of the doubtful Khurāsāni Magaddis, including sentences to illustrate grammar. It would be of value to see if the conclusions here arrived at would be supported or the reverse from an examination of them. But in any case the material at hand is much scantier than it might be and doubtless research would elicit many new forms from the dialects already represented, and beginnings might be made with some as yet untouched apparently by any enquirer, *e. g.*, those of the Delhi *Dalāls* (brokers), the *Kalāls* (generally distillers and liquor-sellers) and the Lucknow *Afiūnchīs* (opium-takers). As regards the criminal classes and tribes, however, Dr. Leitner has shown in his "*Detailed Analysis of 'Abdu'l-Ghafūr's Dictionary*, 1880, that it is almost useless to look among them for philological facts.

In conclusion I may be permitted to remark that if Dr. Leitner's hope, (*Linguistic Fragments*, p. iii.), that the Trade Dialects will be found to preserve an ancient language, is to become a reality, the enquiry must be taken up by more than one person. The range of knowledge required is too wide, and the investigations necessary too minute and searching to admit of one head solving the problems presented, in a satisfactory manner.

Tiomberombi. A Nicobar tale.—By F. A. DE ROEPSTORFF, late offg. 2nd Assist. Supdt., Port Blair, Nicobars, Associate A. S. B.

Both racial characteristics and the historical traditions of a people are commonly found embedded in their religious rites and in their popular tales. This is especially true in the case of uncivilized tribes. Whilst pursuing my studies in the Nicobar language with the object of reducing it to writing I have made a point therefore of noting down the characteristic religious usages of the Nicobarese, and also of chronicling the tales in vogue amongst them which possibly embody historical events of a forgotten past. With regard to their sacred rites I have ready for the press a Statement of "The ceremonies and customs at death, and at mourning for the dead, of the Nicobarese people" taken fresh from the lips of the devotees themselves. These ceremonies yield up their meaning and significance with sufficient clearness and precision; but the case is very different with regard to any historical references and traditions which may be hidden away in the popular tales of the Nicobarese people. For a most singular custom prevails amongst them which one would suppose must effectually hinder the "making of history" or at any rate

the transmission of historical narrative. By a strict rule which has all the sanction of Nicobar superstition, no man's name may be mentioned after his death ! To such a length is this carried that when, as very frequently happens, the man rejoiced in the name of "Fowl," "Hat," "Fire," "Road" &c., in its Nicobarese equivalent, the use of these words is carefully eschewed for the future, not only as being the personal designation of the deceased, but even as the names of the common things they represent ; the words die out of the language, and either new vocables are coined to express the thing intended, or a substitute for the disused word is found in other Nicobarese dialects or in some foreign tongue. This extraordinary custom not only adds an element of instability to the language, but destroys the continuity of political life, and renders the record of past events precarious and vague if not impossible. We must not therefore expect to glean much from these tales as to the past history of the people. Still they are, as a rule, worth preserving, for they exhibit traces of religious ideas which prevailed in former times, of bitter conflicts, and of Nicobar humour. The most popular of these tales I here subjoin ; and I hope to prepare others hereafter.

The Nicobar text, reproduced as literally as possible in the English translation in the parallel column, consists of short abrupt sentences, devoid of any poetic flight whatever. The language of this people is naturally, one had almost said necessarily, abrupt, their teeth being so thickly coated over with betel and lime as to keep the lips thrust wide open, whilst quids of the same generally occupy their mouths. A fluent utterance under these circumstances would be physically difficult and a slow speech broken into short sentences is the inevitable result. To enter into the spirit of the narrative it is necessary to picture to oneself the *raconteur*, usually an old man, his jaws ever and anon at work chewing the indispensable quid of pan, betel, and lime. His auditors, generally the youthful members of the community, are grouped around him. Having refreshed his memory with copious draughts of toddy he commences his story. It has often been heard before, and as the disjointed sentences are uttered with slow deliberation a running commentary is maintained by the audience, the young people, anxious to show that they know what is coming, shouting out the cue of the part about to be related. The jerky character of the diction, therefore, as it appears in the English translation faithfully reproduces the condition of the Nicobarese text with as little sacrifice as possible of the original colouring, the interjected observations of the elders, and the precocious promptings of the juvenile listeners being left to the imagination of the reader to fill in, if he would have a good idea of the narration as it flourishes in the homesteads of the people—the pages of a book cannot adequately convey it.

It is possible that the tale of Tiomberombi may be of foreign, perhaps of Malay, origin. If so it must have been introduced into these islands generations ago, for it now abounds with the peculiarities which characterise the Nicobarese race, breathes their spirit and has been wholly adopted by them as their own, and never fails to afford them delight. The plot of the tale is simple enough. The two points of interest in it are the magical powers exercised by the hero, and the introduction of animals talking. The supernatural is closely interwoven with the lives of these people. The disembodied spirits of the dead surround them, and in their endeavours to return to the world, would effect a lodgment in the bodies of the living, hence, according to the native superstition, the cause of sickness and sometimes of death. To fight, control, exorcise these too familiar and obnoxious spirits the *Manlōēnēs* exist. These, who are a sort of combination of the doctor and the juggler, are on speaking terms with the spirits. They have to go through an initiation which is only complete when they have been in spirit-land, seen, and talked with them. They are supposed to possess the faculty of detecting the presence of these invisible spirits, of seeing them, as well as of vanquishing them. It is to be remarked that Tiomberombi is no *Manlōēnēs*. Not only does he acquire by the gift of the looking-glass no inherent power over the spirit residing in it, for when the glass is lost he is utterly helpless; but when the *peit* (snake) gives it to him, he finds himself unable to manage the spirit of it, and returns with the glass in fear of his life. On the contrary, the spirit of the mirror is in the power of the mighty snake: he is its true master, and it is only through him that our hero has the benefit of its services. Hence Tiomberombi is warned not to open the glass and thereby bring himself face to face with the spirit of the mirror. The *peit* in fact treats him as a poor ragged creature who will probably use the magical powers placed at his service to provide himself with food and clothing, and has no suspicion of the "vaulting ambition" which stirs beneath that lowly exterior. If the tale be not indigenous, it is certainly not of Indian origin: Tiomberombi's wife is no harem or zenana character. For although the tale might be regarded as a sort of humorous satire upon woman's weakness for gossip, which would seem to be so universal a trait as to awaken mirth and "point a moral" even here amongst this semi-civilized race, and no doubt reigns supreme amongst the female members of an Indian household; yet the wife of the tale is a free, independent, masterful person. If it is her irrepressible love of gossip which brings on the catastrophe of the story, it is also she who saves her husband by her provident arrangements and practical genius. Woman is highly esteemed in the Nicobar islands which, it must be remembered, are part of the Malay archipelago and are only politically connected with India.

One word as to the "tékeri." Some Nicobarese say it is a snake which eats snakes. The ophiophagus, however, is not found here. The boa (python *Schneideri*) which is the only very large snake of these parts is well known to the inhabitants, does not eat snakes, and has another name. Others assert that it is a big beast of the jungle like the Akafang which is a spirit animal seen by the Manlōñēs at night. It is described as a rather big creature with an enormous tongue, the head bearing a mane. It might be the effort of the imagination to conceive the lion; I would suggest, however, that the "tékeri" is the tiger. The Nicobarese have been for many years in communication with Europeans and have heard Danish, Portuguese and English spoken. The word may therefore have been an importation from one of these languages, contributions from which have undoubtedly been made to the Nicobarese vocabulary (cf. *infra* "lābré" Anglicé "paper"). Or it may be of Malay origin, and derived from شکر *tëgër*, *strong*.

Inōle onghæ de Tiomberombi.

"Juchtére io at tiū en me?"
 "Hāōh,, io olkāle o(n)g." "Juch-
 tére wat me lōñ,, iéang tentié io
 olkāle o(n)g omiā."

Kāng, kōng, kāng, kōng. "Tiīn
 paiū?" "Tiūē-tiéāē-Tiomberombi!"
 "Tiīn wēn me?" "Tiéāē io olkāle
 o(n)g omiā, da ié io kāno ta kon
 omiā." "Wat-me, lohmi, kéteit kaniut,
 kéteit kanhā." "Oh béharé, io
 éne io en kon omiā."

*Tiomberombi an old tale.**

* "Where are you going?"
 "Oh, I am going to split firewood."
 "Then do not be in a hurry, I will
 go along with you and split fire
 wood for the chief" (or old man).

Kāng, kōng (the sound of the
 footsteps). (Some one asks) "who
 goes there?" (what men?). "I
 Tiomberombi and another." (I—
 we two—Tiomb.) "What are you
 going to do?" "We want to split
 firewood for the chief, for I want to
 marry his daughter (as I want (for)
 wife the child of the chief)." "Cer-
 tainly not, you are poor man (ser-
 vant) your coat and trousers are
 ragged." "Never mind, if the
 chiefs's child is willing."

* Tiomberombi is a tale of love and its troubles. To make that clear it begins with a little introduction, not necessary to the story which follows. Some one is going to cut firewood, when Tiomberombi joins him, saying that he wants to cut wood for "the" old man. On their journey somebody accosts them and a little banter ensues. Kāng, kōng is onomatopoeic for the sounds of the footsteps. Tiūē = I, tiéāē

Juchtérende, harélande, haré-é-
élénde lüē shrinkām. Shéanlérende
na peit ona tékeri de pomōn.
“Kāētéré kanceh ⁽¹⁾ orē ietié,
tiēt sho ⁽²⁾ kāpāh kā entié, kāpāh
tiūē da tékeri.”

“Juchtére tiēn heniōatié makā,
tiēn tioāha, tiēt sho de parā, tiēt
sho de komnān.” “Tiēn io me?”
“Hāā.” “Jo en me tenmēla?”
“Hāā; tiēt sho.” “Jo de tenmēla
baiūhōōāl?” “Jo de tenmēla baiū-
hōōāl, dochne wē gūi, dochne wē
tiōng, dochne wē hifūē.” “Kāē
ta ⁽³⁾ kā.”

Harélihata en tékeri en Tiombe-
rombi kompāhange en tékeri.

* Afterwards he went shooting
for three days. He saw the peit
and the tékeri fighting. “Friend
come! help me to kill (the tékeri)
(says the peit); I do not want to
be killed (entirely), I am being
killed by the tékeri.”

† “Afterwards what hire am I to
to have, what things? I do not
want dollars, nor silver plated
ware.” “What do you want?”
“I don’t know (no).” “Will you
have a looking glass?” “No, I
will not.” “Will you have a magic
looking glass?” “Yes: I want a
magic looking glass, that can pro-
duce houses, ships and boats.”
“(Well then) come (to me) bye
and bye.”

‡ Tiomberombi shoots the tékeri,
and the tékeri expires.

= we two, Tiomberombi is quite Nicobarese. Tiomberombi says that he
is going to cut firewood, for he wants to marry the daughter of the old
man. The other party intimates, that he has no chance, he is a poor
man and ragged. At this T. laughs, for what does that matter if the
girl likes him.

* After this he is out shooting and comes upon the peit and the tékeri
fighting. Peit is used to designate all poisonous snakes. The tékeri the
Nicobarese cannot identify. Some say it is not found in their islands,
some say it might be a snake. If so, I would suggest the ophiophagus.
The peit calls in the assistance of Tiomberombi to save him from the
tékeri, ¹ orē ietié = help me to kill, tiē is the form of the 1st per. pron.
pers. gen, dative and acc. as affix. ² Kāpāh kā = die indeed, (kā added
to make the kāpāh stronger).

† In true Nicobar fashion Tiomberombi bargains for remuneration,
before he gives the help required, and the peit in his extremity
promises him a magic mirror, and tells him to come and claim it
bye and bye ³ ka for makā = later in the day, when the tékeri is killed.

‡ This he succeeds in doing, and then he goes (as any Nicoba-
rese would be sure to do) for his present and walks off with his magic
mirror: but without knowing the secret of it. This is characteristic of

"Jéangtéré ten tiŭŭ," gnæh peit ōl nang Tiomberombi, io ræwe heniōahade." Oræ tenmæla baiū-hōōāl. Tiūende. Shōatéré. "Hat doch, hat léap oliōle, io orīgnafātié." Etieitiéra en peit. "Jo me io wē, io hiléang, io oigne, tewāhagñe *tenmæla, wat me ishāhagñe."

Juchtérende tōng de gñi en Tiomberombi ladiēiē, io oræ kānde kon omiā en Tiomberombi. Juchtére hat sho en omiā ten Tiomberombi da ene lohm.

Jtēak en omiā de hatām, léat kam en kahæ halēa ioang tiafā.

Juchtére ōl hakī-ī-ī ende iokoleit anæh omiā, wīlgnede ōl henlōwe harōē gñi Tiomberombi, mātai Tiom-

"Come with me," said the peit to Tiomberombi, "and receive your hire." He takes the magic looking glass and goes away. He returns. "I cannot manage it, I do not know the word (to speak) (*i. e.* the charm), it (the spirit) will kill me miserably." He applies to the snake, (who says): "If you want to do anything, if you are thirsty, if you are hungry, put the key into the lock of the looking glass, do not open it."

* Then Tiomberombi returns home in the evening and wants to take to wife the daughter of the old man. But then the old man does not want Tiomberombi for he is poor.

† At night the chief is asleep, when the moon being at its highest (Tiomberombi) fetches a magic fruit.

Then *very early* in the morning (expressed by the prolonged final syllable) the chief goes

T., who has great confidence in himself. He has therefore to return and ask the snake to acquaint him with the secret, who tells him that he must use the key but not open the mirror. The meaning of this prohibition is that T. has no theurgic power and would be unable to control the spirit of the magic mirror if it were opened. Note also the low estimation the snake holds our ragged hero in. "If you want to do anything, if you are hungry and thirsty" says the snake, not dreaming of T.'s ambition:

* T. sets off home and wishes to take to himself at once the girl he loves. The old father however, evidently discredits the story of the magic looking glass, and will have nothing to say to him, as he is poor.

† During the night T. sets to, plants a magic fruit in the deep sea and by means of the spirit of the mirror produces an island from the deep sea and erects a house upon it. The text only tells us that he fetches the magic fruit, but it graphically describes how the old man in the morning on casting his eyes over the sea discovers Tiomberombi's new home.

berombi, iuchtére tenfatgnede en omiã.

Tiimende omiã, ohngnede ræwe en Tiomberombi, io léat ko(i)n kontié. Juchtére, ætæt de lëbré Tiomberombi, kômhata de lëbré da omiã. 'Hat sho en Tiomberombi na omiã, dalgnaato.

Juchtére ræwe kände en Tiomberombi, kã ta kände kon omiã; shômhagûe da gñi Tiomberombi da ôl henlôwe.

Juchtére hatae-æ-honde héang danôe. tiong * henkôk, io orîgnafã Tiomberombi. Katôw en Tiomberombi de gñide. Hakôk, hakôk de gñi Tiomberombi, hat taiô.

Juchtére tentioãhlare en Tiomberombi da ôl tiong, fãehange de

to bathe, and when he looks out to sea he sees Tiomberombi's house Tiomberombi's island, then he falls down (in astonishment).

* He weeps and sets off to fetch Tiomberombi, that he might become his son-inlaw. Also Tiomberombi wrote a letter and sent it to the chief. The chief does not want (to meet personally) Tiomberombi for he is shy.

Then Tiomberombi marries: as his wife comes the daughter of the chief; she is brought to Tiomberombi's house in the deep sea.

† Then came sailing (from a distant land) a ship armed with cannon to kill Tiomberombi. He remained in his house. The ship went on firing and firing at Tiomberombi's house but did not hit it.

‡ Then Tiomberombi boarded the ship and cut the noses and cut off

* Great is his astonishment, and it affects him so much, that he falls down and weeps. The text is not very clear on this point. It says that the old man goes off to fetch T. for a son-in-law, then T. writes him a letter and it ends by saying that the chief does not want to meet him, as he is shy. It is quite clear that the tables are turned. Before the old man despised the poor, ragged T. Now he feels shy to approach him in his great prosperity. Whether the letter from T. is friendly, and therefore puts the old man to shame, or the letter is haughty and makes him feel shy, the text leaves to fancy to decide. On the whole the Nicobarese are shy, and affect to be more so, than they really are. Difficulties, however, are overcome, and Tiomberombi attains his wishes and marries the girl whom he loves, who moreover, it is evident from the first, loves him as is seen from his remarks about her in the introduction.

•† No earthly pleasure is unalloyed. When he is happily married and settled enemies appear on the scene to kill him. He is however protected, by magic and sits unconcernedly in his house, whilst the guns of the man-of-war, which had come to destroy him, make ineffectual attempts to hit it.

‡ At length Tiomberombi arises and proceeds to board the ship single handed and mutilates the crew. The man-of-war thereupon returns to

gmoa, iāthange de nang. Tiūngede en tiong henkōk, tiū mātai ; di do (tiŭt doch) da en hæt gmoa, hæt nang da ene fāēhashe da Tiomberombi. Shīēlende sētēt de lēbrē omiā da ōl mātai shom tiŭnmōnggne tiong io kōlung en Tiomberombi.

Juchterēte gñi kānde, gñi komiāde en Tiomberombi. Hataē-ō-ō-hende en shom tiŭnmōnggne tiong henkōk, hakōk hakōkende, hat hēwe mātai, hat taiō.

Tentioāhlare de ōl tiong en Tiomberombi oræ ioang tiufā, kawülle de ōl kamelō, pompangshe en tiong, hemēang te danōē ta ōt de⁴ āh.

Shīēlende fāēhange gmoa, iāthange nang. Tiūngede en tiong. Di do (tiŭt doch) da.

its own country, the king whereof organizes an expedition of ten ship to chastise him.

From the prolonged sound in hataē we are led to infer that the expedition had far to sail. When this formidable expedition arrived, Tiomberombi was with his father-in-law ; only his wife was in the house. He must have left the magic mirror behind him, that would explain how it was that the guns were fired many times, but did no harm, the island had become invisible. Tiomberombi proceeds on board one of the vessels, the crew of which he mutilates in his former manner, and sinks the other nine by throwing magic fruit into the sea. ⁴ āh = *lives* ; it is usual to use this word, and kāpah = die, of vessels. The Nicobarese assert that these words mean in this connexion no more than "keep afloat" and "sink," but I think they do. The Nicobarese may use these terms only in a figurative sense now, and I believe they do, but yet they sacrifice to their canoes (vide "ceremonies at death &c.") after a race. I have seen them sacrifice on removing a canoe yet in the rough log, out of the jungle ; moreover, they use a bow ornament for their boats like the open mouth of some monster. Are these traces of some old worship now obsolete ?

† The ship that was spared returns whence it had set out and reports the hopelessness of the undertaking.

the ears (of the crew). The ship then left for its own country ; they could not succeed, for they had no noses or ears, Tiomberombi had cut them off. Then the chief of the country wrote on paper (i. e., issued an order for) ten ships to make war on Tiomberombi.

* Now in the house was his wife, Tiomberombi (himself) was in the house of his father-in-law. The ten ships of war came sailing (from the distant land) and fired their guns ; (but) they did not see the island, they did not hit.

Tiomberombi boarded a ship and took magic fruit with him, which he throw into the sea ; the ships sank. One ship (however, still) remained. (*lit.* alive).

† (Again) he set to cut noses and cut off ears. The ship left. It could do nothing (not succeed).

Gnahhagñe da nang omiä öl mätai,
tiŕt honganghashe ta doch.

Juchtére iuhggende en pomō-ō-
ēshe enkāne léang Kanōadæ
Petiang de öl gñi Tiomberombi.
Tiin hanēdashien tiong banōne.

Itēaknede öl* katæde kån Tiom-
berombi; (5) haléa shæi kōi kan Ti-
omberombi, itēaknede kån Tiom-
berombi. Kamheng tjuengede
Kanōadæ Petiang, léat kōm de
tenmæla Tiomberombi. Tendök-
tere de mätaide, gnahhagñe de nang
omiä. Léat, léat de kōm tenmæla
Tiomberombi, hæteionnen tiong
banōnē.

Hagnæhhang te tiong ianæ
shōatéré mat mätai Tiomberombi;
heméang danōē tiong ā lä, io ræwe
Tiomberombi.

Tendöktere en omiä tiong da mä-
tai Tiomberombi. Hakök, hakök-
ende taiō öl henwæh, pomtakshede
en henwæen.

* What the valour of men could not achieve was now to be attempted by a woman. An old hag Kanōadæ Petiang comes to pry into the secret of Tiomberombi's immunity from danger and of his success against such odds. She accomplishes her object in the following manner. She was probably an old acquaintance of T.'s wife, to judge from the intimate terms on which they are. T.'s wife goes to sleep in her chair as the other soothingly cleans her hair, (5) haléa shæi has not been literally translated). Having thus lulled her into a deep sleep, Kanōadæ Petiang possesses herself of the magic mirror, which we may surmise the sleeper had tattled to her about and had for security placed under her (head) pillow, and hastens with it to her own country informing the chief thereof that Tiomberombi is now defenceless.

† The chief thereupon orders but a two-masted vessel to proceed and bring Tiomberombi away. He is not going to break a fly upon the wheel. The little ship arrives and is sufficient to accomplish its mission.

They reported to the chief of their country, that there was no chance of success.

* Then came visiting a (very) old woman, her name was Kanōadæ Petiang to Tiomberombi's house. (She wanted to ascertain) what manner of powers he possessed.

Tiomberombi's wife was sleeping in her chair: she (Kanōadæ Petiang) cleaned the hair of Tiomberombi's wife, who slept on. At noon Kanōadæ Petiang left, having taken Tiomberombi's looking-glass. She arrives at her country and reports to the chief, (that the trouble) is over, that she has taken the looking-glass away from Tiomberombi, the cause of the power he possesses.

† He orders one ship to return to Tiomberombi's place; it was (only) a two-masted ship to fetch Tiomberombi away.

The captain arrives at Tiomberombi's island. He fires his cannon and hits the flag and the flag falls.

Hat doch en kân Tiomberombi, heméang ioang de gñi; Tiomberombi léat itōē de mütai tiē kände. Juchteré dæ(a)ngne en Tiomberombi, hæniede io heniongiede kände; de heméang tät kōi.

"Tiū en tenmæla? Tiū en tenmæla?" gnæh Tiomberombi. "Tiū de dök de gñiha?" "Kæ po-mōēshe dā bakō kōi Kanōadæ Petiang." "Oh ié karé.⁽⁶⁾ hæť āh! ſa enō hæť ōť en tenmæla. Kāhaē en shéiau."

Shumiuhata kân Tiomberombi. Dōngle te gñi Tiomberombi en kalæng, io oræ kân Tiomberombi, oræ tioāha, oræ shéiau.

Iuakhëgñē de shéiau, iuakhëgñē enkūne.

Tiomberombi's wife cannot (seil: defend the place), she is alone in the house; Tiomberombi had gone on a visit to her father. Now Tiomberombi ran (*i. e.*, to the canoe) and hurried (across the water) to his wife who was quite alone.

* "Where is the glass? where is the glass?" cries Tiomberombi. "Who has been in the house?" "The old greyhaired (woman) Kanōadæ Petiang." "Ah me! if that be so, then we shall not live! for now the looking glass is not here. Bring a bag."

His wife puts Tiomberombi in a bag. The foreigners came into the house of Tiomberombi; they took away his wife, (all) his property and the bag.

† The bag and the woman were brought on board.

The flag which waved over Tiomberombi's island kingdom is shot away. He is from home at the time on a visit to his wife's father, his wife is alone in the house. But he sees the fall of the symbol of his power, and hastens home to enquire into and repair, if he can, the catastrophe.

In great anxiety as soon as he comes in, he cries, "Where is the magic mirror?" It is nowhere to be found. "Who has been here?" he enquires and on learning that the old woman had been there, he resigns all hope and says that it will cost them their lives. ⁶ hæť āh. *Hat* and *hæt* mean "not;" *hat* is used for the singular, *hæt* for the plural. *Hæt āh* = not live. The meaning supplies "I or we shall not live," *hæt* makes it "we." He resolves upon concealing himself, however; and with the assistance of his wife he is enclosed in a bag and placed amongst the household property. His brave, faithful wife has to face the enemy.

† As he no doubt anticipated, they land and convey everything away, his wife, his property, his all, literally bag and baggage. He thus manages to have himself and his household gods conveyed away together. Our hero in the bag is placed in the bow of the vessel. The vessel sinks to the water's edge at the bow. He is shifted aft,

Juchtérende pomiāmshe lakōŷla, hatiohange en shéiau larille, pomiāmshe larille. Hat doch dök de mātai, (7) kawälhango en shóiau öl kamelæ. Hata-æ-æhende, tendöktere, léat gnung gūide, gnung tiōā, oræ en tiong.

Lūng, lūng, lūng en shéiauende gnahlalende. Keithala en shéiau en Tiomberombi, léat gūöt en inōat en kände iohl tenwā.

Léat oræ kände öl mātai komōrung. (8) Omshōnghande Tiomberombi. "Tiln paiū" ? "Tiūč, tiūč Tiomberombi (9) kenmolö. "Hat me de

Then it happened that the bow sank down: the bag was (therefore) shifted aft. Then the stern of the vessel sank down. They could not reach land (so) they threw the bag into the sea. They sailed and sailed and arrived at their destination, there was no house, no property, that the ship had brought away.

* The bag drifted and drifted on to hard ground. Tiomberombi cut open the bag, his wife had put the knife round his neck with the key.

† The woman was landed in the enemy's country. Tiomberombi travelled about. "Who are you?" (asks someone). "I am Tiombe-

the vessel sinks at the stern. The reason for these extraordinary phenomena is not explained, but it will be seen later that he carried about his person the key of the magic mirror in a string together with a knife. The ship's company fear for the safety of their craft and tracing their danger to something uncanny about the bag dropped it overboard. 7 Kawälhange implies that the stern was level with the water. To throw a thing from a higher to a lower level is kawälhashe. The text indicates thus that the ship was in danger and that the crew were in consequence alarmed.

* The bag containing the hapless Tiomberombi drifted at length to land. His wife had hung the key of the magic mirror and a knife about his neck.

† With the latter he releases himself from the confinement of the bag and wanders about from place to place, till apparently he arrives at his enemy's country where his wife has already been conveyed and is living as a member of the household of the chief. 8 Omshōnghande with the enunciation of the second syllable prolonged to indicate that he wandered about a great deal. During his travels some one, suspecting his appearance probably, accosts him. When the wayfarer says he is Tiomberombi the younger, the suspicions of the interrogator were only deepened. 9 kenmolö = called by another man's name. Tiomberombi, however, assures him, that he is not the national foe, but another Tiomberombi, a man of lowly degree whose occupation is cooking and not

kōlungne?" "Hää, tiüë Tiomberombi kenmolö." "Tiin léap me?" "Oh okpāk dāk." "Tiin léap me déwë?" "Hää, heméang okpāk dāk léap."

Juchtére oknōk en omiä. Iuakha-heude ganlongtei en Tiomberombi öl dāk tōp en kändë: Hat héw omiä. Shinkōehange anēh kām an, hēw ganlongtei en enkāne, hat héw en omiä.

Gnahlagie en kaniom da shiēn héwen gaulongtei de olfang enkāne.

"Hat achtéréshe!" guēh kaniom. "Tiomberombi kām, Tiomberombi omiä."

Ræwe, katiāpe, hat katiāpe karau, henpōn. Juchtérende ghōmbata de öl gūi mang(n)ēh. Hat itēak enkāne, teina. pohōa omiä.

Juchtére hatāmende urōhetshe

rombi, the younger?" "Is it not you who made war?" "No, I am Tiomberombi, the younger." "What work can you do?" "I can boil water." "What else can you do?" No(thing), I know only that one thing, to boil water."

Now it happened after this that the chief was eating. Tiomberombi slipped his finger-ring into the water his wife was to drink. The chief did not see (him do it). His wife drank off at a draught and saw the ring, but the chief did not see it.

* A boy called out, who saw the ring in the woman's mouth.

"It is not true," said the boy, "it is Tiomberombi himself, Tiomberombi the chief."

They seize him and bind him. they do not bind him with chains, but with strings. Then he was brought into a stone house. The woman (i. e., his wife) did not sleep for fear of the chief.

† Now it happened in the night,

fighting. At length he manages to procure his introduction to the presence of his enemy the chief, where he finds his wife, who, however, does not recognize him, as he is probably disguised. In order to make her aware, who he is, he deposits his finger ring in the cup of water, which she is about to drink. On lifting the cup to her mouth she sees and recognizes it, and, no doubt, its owner.

* Tiomberombi successfully eludes the observation of the elders, but he reckoned without an *enfant terrible*, whose presence perhaps he had not condescended to notice. This sharp-eyed youngster detects Tiomberombi's manœuvre and denounces him, and he is then seized, tied up and thrown into a stone built prison. His wife meanwhile, who is still with the chief, spends the night without sleep through fear and dread. Tiomberombi's fortunes are now at their lowest ebb. But succour comes from an unexpected quarter.

† Numbers of rats were heard scampering about the room, in which

komæt. "Da de ra dö, da de ra dö."

"Käëtéré en me," gnæh Tiomberombi nang komæt.

"Juchtéré, tiñ io me (10)kätiñ?"

"Doch en me oræ tenmæla?"

"Tiü tenmæla?"

"Got de kat(ö)ä kanéala omiä, got te tenmæla tiñ."

"Katei en tiéöñde makä."

Kät, kät, kät, kät kanéala omiä endo. Jana iññléré en omiä, keignade 'en komæt. Hatiö-ö-ende, täpük to gñi mang(n)öoh da Tiomberombi léat katiäpe.

"Da de ra dö, da de ra dö."

"Köm de tenmæla?"

"Oh ninne, tiéöñ léat oræ."

Hatiö-ö-ö-hata en tenmæla ta tei

that there were many rats. "Patter, patter, patter" (went their feet).

"Come here," said Tiomberombi to a rat.

"What do you want, friend?"

"Can you get my looking glass?"

"Where is the looking glass?"

"It is under the pillow of the chief, (there) is my looking glass."

* "We will carry it off by and bye."

They worked and worked away at the chief's (head)pillow. If the chief moved in his sleep, the rats stopped. They dragged (it) on and on, and arrived at the stone-built house where Tiomberombi was imprisoned.

"Patter, patter" (went the rats).

"Have you got possession of the looking glass?"

"This is it, we have brought (taken away) it."

They dragged the looking glass

he is imprisoned, and he calls one of them to him. He begs the rat to enable him to regain possession of the mysterious mirror, and tells him he will find it under the head pillow of the chief.

¹⁰ *Kätiñ* I have rendered by "friend." *Tiñ* means "parent." *Kä* is a prefix added to all words of relationship *tiom* = grandparent, *tiñ* = parent, *tiau* = elder { sister brother, *tau* = younger { sister brother *kon* = child, and it is the polite way always to address persons with these words with *kä* as a prefix. In doing so due consideration must be given to the relative ages of the speakers. This is the only way that politeness can be shown and as all are socially equal amongst the Nicobarese this way of address is very nice.

* The rats promise to fetch the looking glass later in the night. *Kät*, *kät* is onomatopoeic for the working of the rats. The chief sleeps soundly, but occasionally he moves his arms and they (keigna=wait, stop) hide. Having secured the mirror, they drag it into the house, where Tiomberombi lies bound, and up to where, about his neck, by the fore-

Tiomberombi. Kāētéré da tiuk
tenwā da olkolāhla. Tewāhata.

"Tiin io me," gnæh iwi de ől tən-
mæla.

"Hæt āh tiéāē kōlungne, hat
mātai itā, hat őt kantié."

"Tiēn io me?"

"Wē tiōng, wē henwæh, wē lifüē!"

Wē, wē, wē, wē, léat. Shām-
hagne de tiōng ől henlōwe.

"Kashī¹¹ kāē tiē ifæ makū."

"Katei de tiéōi."

Oræ enkāne, kaētérénde.

Jūakhégñe enkāne de ől tiōng.

Wēla. lōē, hatæ-æ-æhende, io
tiū Tiomberombi. Urōhetshe
henwæh da mat tiōng Tiomberombi,
munhang en omiā mātai. Fōha
tapōude en omiā mātai, endūē
henkōk Tiomberombi.

on and on till it came to Tiombe-
rombi's hands. It came to where
the key was about his neck. (Then)
he put the key in the lock.

"What do you want," said the
spirit of the mirror.

"We two (T. and his wife) can-
not live on account of this war,
"this is not our country, I have
"not got my wife."

"What do you want?"

"Produce a ship, flags, boats!"

On and on the structure grew
and now it is finished. The ship
is brought into deep water.

* "What about the absent mo-
ther of you all, then?"

"We will bring her."

† They took away the woman,
she comes.

The woman goes on board the ship.

The sails are set, and Tiombe-
rombi goes sailing off. There are
many flags on Tiomberombi's ship,
and the chief of the country is
(very) angry. He beats his cheeks
for Tiomberombi's guns are bigger
(than his).

sight of his wife, the key of the looking glass and a knife had been hung.
The rats so place the mirror in juxtaposition with the key, that the tied
up hands of the prisoner are able to insert the key in the glass, when
once more Tiomberombi is master of the situation. The bonds fall off,
the prison falls, and soon he has got his ship and boats ready with pen-
nons flying in triumph.

* Then he thinks of his faithful wife. There is a poetic touch in
his appeal: kashī kāē tiē ifæ makā. ¹¹ Kāē is a demonstrative pronoun
rarely used and refers to persons or things absent. He speaks to the
spirits under his orders and asks about "their mother."

† The spirits of the mirror anon bring her on board. Tiomberombi
now gaily sails forth with all his canvas spread and flags displayed, his
erewhile victor beating his cheeks with impotent rage in the meantime,
as he beholds Tiomberombi's triumphant departure to his own land.

Tiū en Tiomberombi, wēhähāt iūk, päniäp omtōm, mätai léat hat öt.

Tendöktéré Tiomberombi de mätaide.

Wilgnede komiä, hēw, wēhala henwäh Tiomberombi, gñi Tiombe-rombi, mätai Tiomberombi. Urō, hetshe henwäh Tiomberombi de mat gñi. Io dök de mätai komiäde.

"Äh kömekät?"

"Äh."

"Kacī en me?"

"Hää, tiit orī, hantā wē iūk."

"Kashihede makā?"

"Oh, wē gñi de lapōē," guæh Tiomberombi nang komiäen.

"Watme inōle onghæ da ene

* Tiomberombi departed. Tiomberombi raised a surf (by magic). All died, the country disappeared.

Tiomberombi arrived at his own country.

His mother-in-law looked out and spied the flags, Tiomberombi had hoisted, his house, his island. There were many flags about his house. He came to his mother-in-law's village.

"Are those with you (i. e., my daughter) alive?"

"Alive."

"How did you accomplish it?"

"No, we did not kill, we only raised a surf."

"What now (how about bye and bye)?"

"Now we will make a nice house," said Tiomberombi to his mother-in-law.

"Do not tell the tale or else 'the

* And when by the potent aid of the spirit of the looking glass Tiomberobim has raised a tremendous surf and swept him and his land away, his success is complete. In due course the spot is reached where his old home had been and apparently the magical properties of the mirror are resorted to again to restore in a twinkling his former island home as it was before misfortunes overtook him, for his mother-in-law, when scanning the horizon for any signs of the return of the captives, spies Tiomberombi's victorious pennons waving over his house and island complete as of yore. Tiomberombi with somewhat unusual ardour is soon in the arms of his mother-in-law (!) and answering her anxious enquiries as to his own and her daughter's welfare (kömekät = me kükät). He tells her of the utter extinction of his foes, and how it had been accomplished, and then they fall to picturing out a bright and prosperous future, which is to be theirs by the aid of the magical mirror. Taught by experience he strictly enjoins, however, both mother-in-law and wife not to reveal the secret of their prosperity. But alas!! for the frailty of woman's tongue: whilst he is absorbed in eating, the women folk gossip about it; the island breaks up and is submerged and weeping and wailing they go down to their watery grave.

däkne mätai makā!" Juchtére
 Tiomberombien oknōk. Oliōle'n
 komiāen, ōliōl' enkāne en inōle
 onghæ. Pomdaknede en mätai,
 pompangshede. Tiim ofæ. Kāpāh-
 ende omtōm. Léatende.

island will break up again." Now
 Tiomberombi was eating. His
 mother-in-law and his wife related
 the story. Then the island broke
 up and sank. They all cried out.
 They all died. Finis.*



Notes on the history of Religion in the Himālaya of the N. W. Provinces.

Part I.—By E. T. ATKINSON, B. A., F. R. G. S., B. C. S.

In reading the wonderful story told by the great Chinese travellers Fah Hian and Hwen Thsang of their wanderings through India in the fifth and seventh centuries, one cannot but be struck with the greatness and importance of Buddhism as then understood, yet in the tenth century we hear very little about it, and about the twelfth century Buddhism appears to have ceased to be the faith of any considerable section of the Indian people. The inquiry naturally suggests itself, how did Buddhism disappear; what were the causes which effected the downfall of a system of religion which, for fifteen centuries occupied the thoughts, and held the affections of a great part of the population of this vast country, and had such defenders and expounders as Aśoka, Kanishka, Nāgārjuna, and the Guptas: a system too which has given us learned theologians, subtle metaphysicians and great writers on almost every subject whilst its apostles have converted the nations of Eastern Asia from Mongolia on the north to the islands of the Eastern Sea on the south. In the search for an answer to these questions one finds little aid in the existing literature devoted to the religions of India. This for the most part consists of compilations from works which, however interesting and, however valuable they may be, have no part in teaching or guiding the actual living beliefs of the masses. For this reason we are compelled to adopt the analytic method, and first of all ascertain who are the deities worshipped by the people and the ritual in actual use, and then attempt to trace

* The Rev. C. H. Chard, Chaplain of Port Blair, has very kindly helped me with the English part of this paper.

out the history of the various developments of the ascertained primitive forms of belief in India which have combined to give us the popular religion of the present day. Every one that deals with a subject like the present one, must feel the magnitude of the task, and the necessity that exists for the greatest caution in attempting to establish any general propositions. The notes on this subject that I have collected are therefore offered as a humble effort to aid others in the true method of inquiry into the history of religion in India, and I am not aware that their subject has ever been noticed before. My researches have been confined to the tract in the Himálaya between the Sárda on the east and the Tons on the west including the British districts of Kumaon, Garhwál and Jaunsár under the Government of the North-West Provinces of the Bengal Presidency. It is to be understood, therefore, that my remarks refer only to this tract, and that whatever merit they may be held to possess is due to the fact that they are the outcome of a very close examination of the religious phenomena of a country famous in Indian history. The oldest Indian books mention the great shrines of Badarináth and Kedárnáth, mounts Meru and Kailás, the holy lake Mánasarovara and the places become sacred by the wanderings of Krishna and Arjuna, Ráma and Sítá, Draupadí and the Pándavas and in comparatively modern times the scene of the labours and the final resting-place of the great reformer Sankara Achárya.

Religion in India.—There is no country, perhaps, in the world in which religion exercises more influence on social and political life than in India. Religion gives the key-note to most of the great changes that have occurred in the history of the races inhabiting this country from the earliest ages to the present day. To almost every individual in this land its forms are ever present and exercise a perceptible influence on his practices, both devotional and secular, and yet the true history of religious thought in India has yet to be written. There is an esoteric school and an exoteric school: to the former too much attention has been paid, to the great neglect of the living beliefs which influence the masses of the people. Most writers on India have looked to the Vedas and the works connected with them as the standard by which all existing forms of religious belief in India are to be judged and to which all are to be referred. Influenced doubtless by the antiquity, richness and originality of the Vaidik records, they have sought to connect them with the popular religion, and have viewed modern beliefs more as to what they ought to be than as to what they actually are. As a matter of fact the Vedas are practically unknown to, and uncared for, by the majority of Hindus. There is no translation of them into the vulgar tongue in use amongst the people, and it would be contrary to the spirit of Bráhmanism to

popularise them or their teachings. They are less known, therefore, to the Hindús than the Hebrew original of the Old Testament is to the majority of the Christian populations of Europe. Some sects do not acknowledge their authority in matters of faith and practice, and they are in no sense 'a Bible' to the masses except to a few of the learned, and have little practical influence over modern religious thought outside the same class. Though portions of the Vedas, notably of the collection ascribed to the Atharvans, are recited at ceremonies, and verses from them occasionally occur in the domestic ritual, as a rule, neither the celebrant nor the worshipper understand their purport. They are learnt by rote and those employed in the ceremony regard the words used more as spells to compel the deities than as prayers for their favour. Yet we would ask the ordinary student of Indian affairs to formulate what he understands by Hinduism, and he will at once answer, the religion of the Vedas. We must, however, accept the term Hinduism as a convenient one, embracing all those beliefs of the people of India which are neither of Christian nor of Musalmán origin. But within this pale we have sects as divided from each other as members of the Society of Friends are from Roman Catholics. We have followers of the Vedas, of Bráhmaism, of Buddhism and of the polydæmonistic tribal cults of the aboriginal populations and of eclectic schools, religious and philosophical, of every kind and class. The religion of the Vedas never took hold of the mass of the people.* It was followed by Bráhmaism designed to exalt the priestly class, but even this system had to abandon the Vaidik deities and admit the dæmons of the aborigines to a place in its pantheon, or otherwise it would have perished. Buddhism was originally a protest against sacerdotalism, not necessarily against the Bráhmaical caste, but it too succumbed to dæmonistic influences, and degraded and corrupted, fell an easy prey to its rival Bráhmaism. Both sought the popular favour by pandering to the vulgar love of mystery, magical mummeries, superhuman power and the like, and Bráhmaism absorbed Buddhism rather than destroyed it. The Buddhist fanes became S'aiva temples and the Buddhist priests became S'aiva ascetics or served the S'aiva temples, and at the present day the forms and practices in actual use may be traced back as readily to corrupted Buddhism as to corrupted Bráhmaism. There is a period of growth and of decay in religious ideas as in all things subject to human influence, and precisely the same rules govern their rise, culmination and fall in India as in Europe. Every principle or thought that

* By this is meant the great majority of the races of India. There have always been some with learned leisure who have adhered to the higher faith in one God and have never bowed to Siva or Vishnu, but their principles are unknown to the cultivator, the trader and the soldier, or at least only in a very diluted form.

has moved the schools of Greece or Rome has equally shared the attention of Indian thinkers, and in the kaleidoscopic mass of beliefs that can be studied in any considerable Indian town, we may perceive analogies of the most striking character to the broad forms of belief and modes of thought in many European cities.

Religion in the Himálaya.—In examining the condition of religion in the Himálayan region we find a curious blending of pre-Bráhmanical, Bráhmanical and Buddhistic practices which it will take some time and attention to separate and ascribe to their original sources. It would doubtless be easy to dispose of the question by stating that the prevailing religion is a form of Hinduism. This would be perfectly true, but at the same time could convey no definitive idea to the inquirer's mind as to what the real living belief of the people is. For the more complete examination of the forms of religion existing in the N. W. Himálaya we possess a record of the teaching in 350 temples in Kumaon, in about 550 temples in Garhwál and in about 100 temples in Dehra Dún and Jaunsár-Báwar. For the 900 temples in Kumaon and Garhwál we know the locality in which each is situate, the name of the deity worshipped, the broad theological division to which the deity belongs, the class of people who frequent the temple, and the principal festivals observed. The analysis of these lists shows that there are 250 Saiva temples in Kumaon and 350 in Garhwál, and that there are but 35 Vaishnava temples in Kumaon and 61 in Garhwál. To the latter class may, in a certain sense, be added 65 temples to Nágarája in Garhwál which are, by common report, affiliated to the Vaishnava sects, but in which Siva also has a place under the form of Bhairava. Of the Saiva temples, 130 in Garhwál and 64 in Kumaon are dedicated to the Sakti or female form alone, but of the Vaishnava temples in both districts only eight. The Sakti form of both Siva and Vishnu, however, occurs also in the temples dedicated to Nágarája and Bhairava, or rather these deities and their Saktis are popularly held to be forms of Vishnu and Siva and their Saktis. Of the Saiva Sakti temples, 42 in Garhwál and 18 in Kumaon are dedicated to Kálí, whilst the Sakti forms of the Bhairava temples are also known as emanations of Kálí. Nandá comes next in popularity and then Chandiká and Durgá. The remaining temples are dedicated to the worship of Súrya, Gaṇeśa and the minor deities and deified mortals and the pre-Bráhmanical village gods who will be noticed hereafter. The outcome of this examination is therefore that Siva and Vishnu and their female forms are the principal objects of worship, but with them, either as their emanations or as separate divine entities, the representatives of the polydæmonistic cults of the older tribes are objects of worship both in temples and in domestic ceremonies.

Dæmonism.—Whatever may have been the earliest form of religious belief, it is probable that it was followed by a belief in dæmons or super-human spirits to which the term 'animism' is now applied. The Greek word 'dæmon' originally implied the possession of superior knowledge and corresponds closely to the Indian word '*bhūta*,' which is derived from a root expressing existence and is applied in the earlier works to the elements of nature and even to deities. Śiva himself is called *Bhūteśa* or 'lord of *bhūtas*.' With a change of religion the word dæmon acquired an evil meaning, and similarly the word *bhūta* as applied to the village gods carries with it amongst Brāhmanists the idea of an actively malignant evil spirit. Animism implies a belief in the existence of spirits, some of whom are good and some are bad and powerful enough to compel attention through fear of their influence. They may be free to wander everywhere and be incapable of being represented by idols, or they may be held to reside in some object or body, whether living or lifeless, and this object then becomes a fetish* endowed with power to protect or capable of being induced to abstain from injuring the worshipper. Examples of both these forms occur amongst the dæmonistic cults of the Indian tribes. As observed by Tiele† "the religions controlled by animism are characterised first of all by a varied, confused and indeterminate doctrine, an unorganised polydæmonism, which does not, however, exclude the belief in a supreme spirit, though in practice this commonly bears but little fruit; and in the next place by magic which but rarely rises to the level of real worship * *. In the animistic religions, fear is more powerful than any other feeling, such as gratitude or trust. The spirits and the worshippers are alike selfish. The evil spirits receive, as a rule, more homage than the good, the lower more than the higher, the local more than the remote, and the special more than the general. The allotment of their rewards or punishments depends not on men's good or bad actions, but on the sacrifices and gifts which are offered to them or withheld." Even the Aryan religion held the germs of animism, but it soon developed into the polytheism of the Vedas, and this again gave rise to a caste of expounders whose sole occupation it became to collect, hand down and interpret the sacred writings and who in time invented Brāhmanism. Buddhism, as we shall see, was an off-shoot of Brāhmanism, and it is to the influence of these three forms of religious belief—Animism, Brāhmanism and Buddhism—that we owe the existing varied phases of Hinduism, and paradoxical as it may seem the masses are more Animists and Buddhists in their beliefs at the present day than Brāhmanists. We

* See Max Müller's Hibbert Lectures, p. 56.

† Outlines of the history of Ancient Religions, p. 10, and Wilson in J. R. A. S., V., 264.

shall first of all take up the festivals commonly observed by the Kumaon Khasiyas as the people of that country are commonly styled by their neighbours, then the domestic ritual, and then the various forms of the deity worshipped in the numerous temples that stud nearly every hill and valley of any importance throughout the Kumaon Himálaya. We shall then follow the historic method, and attempt to trace out the development of the existing forms from the earlier Vaidik and Pauránik deities, and show how the pre-Bráhmañical conceptions have not only been engrafted on the Vaidik ideas, but have practically swallowed them up and led to the existing rich confusion.

Kumaon calendar.—Before proceeding with a description of the religious festivals observed in Kumaon, it is as well to note that there are two modes of computing time in common use, one founded on the sidereal divisions of the months, and the other on an intricate adjustment of the solar to the lunar year.* The local names of the months are:—Chait, Baisákh, Jeth, Asárh, Saun, Bhádo, Asoj, Kárttik, Mangsir, Pús, Mán and Phaguñ. The Saka *samvat* follows the solar year, and is used by the great mass of the Khasiya population, and in the calendar of festivals dedicated to the worship of the pre-Bráhmañical forms and the indigenous local deities. The Vikramáditya *samvat* is adapted to the luni-solar year. It is only used by the later and more orthodox rulers in public documents, and is confined amongst the people to the calendar of festivals borrowed from the use of the plains, the calculation of nativities by the fashionable Jyotishís and generally in all orthodox ceremonies. The gradual conversion of the Khasiya population to Bráhmañism is a phenomenon well marked in this portion of the Himálaya. The prosperous Dom (outcaste) mason becomes a Rájput and the so-called Khasiya Bráhmañ, a Bráhmañ, and both mark their advancement in the social scale—for here orthodoxy means respectability—by adopting the stricter forms in use in the plains. One conclusion we may safely draw that the use of the Saka era in secular matters and the solar calendar in religious observances is characteristic of the non-Bráhmañised populations, and may be adopted as a safe guide to the decision whether a given observance is of Bráhmañical or other origin.

Chait.—The month Chait is considered the first month of the year in Kumaon. The eleventh of the dark half is known as the *Pápa-mochaní ekádásí*, and is observed by those who keep the elevenths of every month sacred. The first nine nights of the *sudi* or light half are known as the *Chait nava-rátri* and are sacred to the worship of the Sakti form of S'iva

* For an elucidation of these systems: see Thomas' Prinsep, II, 148; H. H. Wilson's works, II, 151; VII, 284; Calcutta Review, I, 257; XIII, 65.

as Nava Durgá, the nine forms of Durgá. These are in common acceptance here :—Sailaputri, Brahmacháriní, Chaṇḍaghaṇṭá, Kushmáṇḍá, Skandamátá, Kátyáyini, Kúlarátrí, Mahágaurí and Siddharátrí. Durgá is also worshipped under her other forms as Kálí, Chaṇḍiká, &c., at this season. Those who eat flesh, sacrifice kids to the goddess, using the Nirṛiti name in the presentation ; and those who do not eat flesh, offer grain and flowers and use the name of one of the milder forms in the consecration. On the ninth of Chait *sudí* known as the *Ráma-navamí*, festivals are held at the temples of the Vaishṇava form Rámapádaka in Almora, Uliyagáon and Mási. The Chait *nava-rátrí* is also the season of the great *sangati* or fair at the Sikh temples of Guru Rám Rái in Dehra and Srinagar. The eleventh of the light half is known as *kámadá*, when widows worship Vishṇu and offer grain, fruit and flowers to the deity either in a temple or to a *sátayráma* stone in their own home. The day of the full moon is observed as a festival in the temple of Akásabhájiní in Saun. On this day also the houses of the pious are freshly plastered with a mixture of earth and cow-dung and no animal is yoked : hence the name *Ajoṭá*.

Baisákh.—The eleventh of the dark half of Baisákh is known as the *Varárhini ekádaśí* and is observed by widows like the *kámadá* of the light half of Chait. The third of the light half is called the *Akshaya* or *Akhai tritíyá*, and no one ploughs on that day lest some misfortune might occur. The Sikhs call it the *Sattva-tíj* and observe it as a festival. The *Gangá-saptamí* or seventh devoted to the river Ganges is marked by special services in several places along the Ganges. The observances prescribed for the *Mohaní-ekádaśí*, or eleventh styled *Mohaní*, are seldom carried out in Kumaon except by those who, having suffered much in this life, are desirous of obtaining a better position at their next birth. Old men and women amongst the poorer classes worship Vishṇu on this day. The fourteenth of the light half is known as the *Nara-Simha chaturdaśí* which is observed in the Vaishṇava temples. The day of the full moon called the *Mádhava pūrṇimá* is also held sacred and assemblies are held at several of the Saiva and Nága temples on this day, such as Pinákeśwara, Gaṇanátha, Bhairava in Rhaladakot, Bhagotí in Dhaundyolsyún and Siteśwara, also at Vasukí Nága in Dánpur and Nágadeva in Sálam.

Jeth.—The eleventh of the dark half of Jeth is called the *Apara ekádaśí* or 'super-excellent eleventh,' the best of all the elevenths of the dark half which are held sacred by the pious. No noted fair takes place on this day and it is merely a nominal festival in these hills. The last day of the dark half is called *Vatá-sávitrí amávasyá*, when Sávitrí, the personified form of the sacred *Gáyatrí* verse, is worshipped by a few. The second of the light half of Jeth is known as the *Anadhyáya dwitíyá*, and on this day no new task is given by a teacher to his pupils. The tenth of the light half is

called the Jeth *Dasahra*, which is generally observed throughout the lower pāṭṭis or subdivisions. Special assemblies are held on this day at the temples of Umā at Karnprayāg, Uparde at Amol, Bāgeśwara, Koteśwara and Sītā at Sītābani in Kota, &c. This *Dasahra* marks the birth of Gangā, the worship of the Nāgas and Mānasa. The eleventh is called the *Nirjalā ekadaśī*, when drinking water is forbidden to those who profess to be devout. The day of the full moon is like all other similar dates observed by plastering the floor with cow-dung and earth and giving presents (*nishrāu* or *nirshau*) of rice and money to Brāhman̄s.

Asārh.—The eleventh of the dark half of *Asārh* is known as the *Yoginī ekadaśī*, a nominal feast, only observed by those who have vowed to keep holy every eleventh throughout the year. During this month festivals are held in the temples dedicated to Bhairava and Nāgarāja in Garhwāl. The eleventh of the light half of *Asārh* is known as the *Harīśayanī ekadaśī*, the day when Vishnu falls asleep, which like the *Haribodhini ekadaśī*, or eleventh of the light half of Kārttik, when Vishnu awakes from his sleep, is esteemed specially sacred amongst 'elevenths' and is generally observed throughout these districts. The day of the full moon is observed in the same way as in Jeth as a domestic festival.

Sāwan or *Saun*.—The eleventh of the dark half of *Sāwan* or *Saun* has the local name *kāmikā*, but is merely observed as a day of rest and one of the *ajōṭa* days when the cattle are not harnessed. When the thirteenth of any month falls on a Saturday it is called *Suni trayodaśī* and is held sacred to Śiva, no matter in what month or in what half of the month it takes place. Similarly, when the last day of the dark half of the month occurs on a Monday, it is called the *somavati amāvasyā*, which is generally observed as a day of rest and the *śrāddha* of ancestors is performed without, however, making the *piṇḍas* as prescribed for the *Ś'rāddhapaksha* of Bhādo. On this day also an iron anklet called *dhagul* is worn by children to guard them against the evil eye and the attentions of *bhūtaṣ* or sprites. The eleventh of the light half is known as the *Putradā ekadaśī*, but has no special importance. On the day of the full moon, after bathing in the morning, Hindus retire to some place near running water and making a mixture of cow-dung and the earth in which the *tulsi* plant has grown, anoint their bodies; then they wash themselves, change their sacrificial threads and perform the ceremony of *Rishi-tarpana* or worship of the seven Rishis or sages. They then bind *rākhis* or bracelets of silk or common thread around their wrists and feed and give presents to Brāhman̄s. The common name for this festival in Kumaon is *Upa-karma*, equivalent to the *Salauna* or *Rakshābandhana* or *Rākhibandhana* of other districts. On this day festivals take place at the Sun temple in Sūi-Bisang, Bārāhī Devī at Devī Dhūra and Patuwā in Sūi. A commercial fair takes place at Devī Dhūra on the *Sudi pūrṇimā*.

Bhādo.—The fourth of the dark half of Bhādo is known as the *San-kashī chaturthī* when Gaṇeśa is worshipped and offerings of *dāl* grass and the sweetmeat called *ladū* composed of sugar and sesamum seed are made. These sweetmeats are here called *modak*, of which ten are usually presented, and of these five belong to the officiating priest and five to the worshipper. This observance is common amongst all Hindus. The eighth of the dark half is the well-known *Janmāshṭamī*, a great festival amongst the Vaishnavas, held in honour of the birth of Kṛishṇa. The eve of this festival is spent in worship in the temples. Local festivals are also held during this month in honour of Kelu Pīr, Gangānātha, Kārttikeya, Dīpa Devī and Pushkara Nāga. The eleventh of the dark half is known as the *Ajāmbikā ekādāśī* and that last day is called the *Kusāvartī amāvasyā*, when the *kuśa* grass is collected by Brāhmins for use in their ceremonies. Locally amongst the Tiwāri Brāhmins the ceremony of changing the sacrificial thread is performed on the third of the light half of Bhādo, which is commonly known as the *Haritālī tritīyā* from the *Hasta nakshatra* or asterism. The fourth is known as the *Gaṇeśā-chaturthī* and is the date of a fair at Thal Kedār in Waldiya and at Dhvaj-patikeśwar near Jarkandār in Askot. The fifth, is known as the *Nāga* or *Rishi* or *Birura-panchamī*.

Nāga-panchamī.—This is the great day on which the serpents are worshipped and the date of the fair in honour of Ugyāra Mahārudra at Papoli in Nākura and Karkotaka Nāga in Chhakhāta. Rikheśwar is a title of Śiva as lord of the Nāgas, a form in which he is represented as surrounded by serpents and crowned with a chaplet of hooded snakes. The people paint figures of serpents and birds on the walls of their houses and seven days before this feast steep a mixture of wheat, gram and a sort of pulse called *gahat* (*Dolichos uniiflorus*) in water. On the morning of the *Nāga-panchamī* they take a wisp of grass and tying it up in the form of a snake dip it in the water in which the grain has been steeped (*birura*) and place it with money and sweetmeats as an offering before the serpents.

The chief festival, however, in Bhādo is that held on the *Nandāshṭamī* or eighth of the *Sudi* or light half. It is popular all over the upper paṭṭis (sub-divisions) of the two districts and is the occasion of a great assembly in Almora. Great numbers of kids are sacrificed and occasionally young male buffaloes. At Almora a young buffalo is offered and Raja Bhīm Singh, the representative of the Chand Rājas, gives the first blow with a talwār and afterwards the others kill the animal. In several villages this is made the occasion of a cruel custom. The animal is fed for the preceding day on a mixture of *dāl* and rice and on the day of the sacrifice is allowed sweetmeats and, decked with a garland

around its neck, is worshipped. The headman of the village then lays a talwár across its neck and the beast is let loose, when all proceed to chase it and pelt it with stones and hack it with knives until it dies. This custom especially prevails in villages where the form Mahisha-mardani is worshipped, 'she who slew the buffalo-demon Mahisha.' A similar custom, however, called *dhurangí* obtains in the Bhoṭiya parganahs of Kumaon where there is no trace of the buffalo-legend. There, when a man dies, his relatives assemble at the end of the year in which the death occurred and the nearest male relative dances naked with a drawn sword to the music of a drum, in which he is assisted by others for a whole day and night. The following day a buffalo is brought and made intoxicated with bhang and spirits and beaten with stones, sticks and weapons until it dies. It is probable that this custom of slaying the buffalo is an old one unconnected with any Bráhmaṇical deity. A story fabricated not very long ago in connection with the Nandá temple at Almora is both amusing and instructive as to the growth of these legends. My informant tells how the worship of Nandá at Almora had been kept up ever since it was established there by Kalyán Chand, but that when the British took possession of Kumaon, the revenue-free villages attached to the temple were sequestered by Mr. Traill.* Three years afterwards (1818) Mr. Traill was on a visit to the Bhoṭiya valley of Juhár, and whilst passing by Nandá-koṭ, where Nandá Deví is supposed to hold her court, was struck blind by the dazzling colour of the snow. The people all told him that unless the worship of the goddess were restored his temporary snow-blindness would remain for ever, and on his promising to this effect, his eyes were opened and healed. In Almora, there is this peculiarity in the worship of Nandá, that two images are made of the stock of the plantain tree and on the morrow of the festival, these are thrown or, as the people say, sent to sleep on a waste space below the fort of Lalmandi (Fort Moira) and thus disposed of.

Durbáshṭamí.—A ceremony known as the *Durbáshṭamí* sometimes takes place on the *Nandáshṭamí* and sometimes on the *Jannáshṭamí* or other holy eighth of this month. On this day women make a necklace of *dáb* grass which they place around their neck and after ablution and worship give it with the *sankalpa* or invocation as a present to Bráhmans. They then wear instead a necklace of silk or fine thread according to their means. They also put on their left arms a bracelet of thread with seven knots known as *ḍor*. Men wear a similar bracelet of fourteen knots on their right arms which is called *ananta*, as they first wear it on the *ananta chatur-*

* On the British conquest in 1815, all claims to hold land free of revenue were examined and in many cases, owing to the difficulty of obtaining satisfactory evidence in support of the claim, considerable delay arose in issuing orders.

daśī or fourteenth of the light half, which is further observed as a festival at Benināga in Baraun, Bhagling in Sor and Chhipula in Askot and also at the temples to Ghaṇṭakarna in Garhwāl. The eleventh is locally known as the *Pārsvapari ekūḷaśī* and the twelfth as the *Bāman* or *Srāvāṇa dvādaśī* from the *Srāvāṇa nakshatra* or asterism, but both are merely nominal festivals. The day of the full moon is observed as in other months.

S'rāddha-paksha of Asoj.—The entire dark half of Asoj is known as the *S'rāddha-paksha* or fortnight devoted to the repose of the manes of ancestors. It is also called the *Mahālaya pārvana s'rāddha* from the formula used each day in worshipping the manes. The ninth is known as the *S'rāddhiyā navamī* when the ceremonies are performed for a mother. On this day, the children by a legal wife make small balls of cooked rice and the children by a concubine make the same of raw rice ground with water on a stone. These cakes or balls are called *piṇḍa* and are worshipped in remembrance of the deceased. They are then given to a cow to eat or are thrown into a river or on to some secluded waste piece of ground. The practice of making *piṇḍa* of boiled rice is, however, confined to those castes who claim connection with similar castes in the plains and is unknown amongst the Khasīyas, who make the *piṇḍa* of raw rice as already noticed for the offspring of a concubine. If a father has died his *s'rāddha* is performed on the same date of the fortnight: thus if he died on the third of Magh *syūti*, his *s'rāddha* in the *s'rāddha-paksha* or *kanyāgati* will be held on the third, but if he died on the ninth or any succeeding date, if the mother be already dead, as a father's *s'rāddha* cannot be held after a mother's, the ceremony must be observed on the eighth. In addition to this the anniversary of the death of a father is always separately observed by the better classes and is called '*ekoddishṭa*' or '*ekoddṛishṭa*' when 'he alone is looked at' or is made the object of worship. If he died during the *s'rāddha-paksha*, the day is called '*ekoddishṭa khyāta s'rāddha*,' and though it falls on the ninth or succeeding day is observed as the anniversary. The last day of the dark half is called *Amāvasyā s'rāddhiyā*, when the names of all ancestors are mentioned and worshipped, but *piṇḍas* are made and offered only for the three male paternal ancestors, father, grandfather and great-grandfather. The three ascending cognates and agnates are all honoured on this day, which is the only one observed by Doms. The *s'rāddha* of girls who die before marriage is never made, and of boys only if they have been invested with the sacrificial thread. The *s'rāddha* of a girl who has married is made by her husband's brother's family, if she dies childless her husband's brother's son, or if her husband has married twice and has offspring, her step-son (*sautela*) performs the ceremony. In default of these, the older or other brother of the husband will officiate; her own brothers never can take part in any ceremony connected

with a sister who married. The eleventh of the *śrāddha-paksha* is known as the *Indriyā ekādaśī*, but has no particular observances attached to it apparently.

Asoj sudi.—The first nine nights of the light half of Asoj called the *Asoj navarātri* are, like the first nine nights of Chait, especially devoted to the worship of Sakti. The first day is called *Devī-sthāpana*, on which the idol is set up and the preparations are made. The eighth is the 'mahāshṭamī' or great eighth, when the pious fast all day and make ready for the great or last day, when kids are sacrificed and the proceedings continue during the whole night. The tenth of the light half of Asoj is here called the *Vijaya-daśamī* or the tenth of victory, and on this day a festival is held to commemorate the commencement of Rāmā's expedition to Ceylon (Lanka) for the release of Sītā. It is locally known as *Pāyata* or simply *Pait*, from the well-known sweetmeat *peṭha* which forms an important item of the feast given to friends and relatives on this day. Some also now pay honour to the young green sprouts of the more useful crops, such as wheat, gram, rape, as well as on the *Karka sankrānta*, when the custom is universally observed. The village gods Goril and Ghatku or Ghatotkacha have festivals on the *mahāshṭamī*. The eleventh is known as the *Pāpānkuṣa-ekādaśī* or eleventh of the *ankuṣa* (elephant goad) of sin, and in some copies as *Pārśvapari*. The day of the full moon is called *Kojāgarī*, and from this day the gambling of the Diwālī commences.

Kārttik.—The eleventh of the dark half of Kārttik is known as the *Rāma ekādaśī* or eleventh of Rāma and Lakshmi. The entire dark half is called the *Dīpa-paksha* or 'fortnight of lamps.' The *Pādma-Purāṇa* alludes to the eleventh of Rāma as appropriate to the gift of lighted lamps as well as to the *Naraka-chaturdaśī* or fourteenth and fifteenth. The thirteenth is set apart for the gift of lamps to Yama, and flowers should be offered on the two following days, when bathing also is enjoined. The *Dipāwalī amāvasyā* or last day of the dark half is known as the *Śukha-rātri* or happy night which Viṣṇu passed in dalliance with Lakshmi and also as the *Diwālī*. Women take part in the observances of the night and some keep the previous day as a fast and devoutly prepare the materials for the night's worship when none are allowed to sleep. Even the lighting of lamps for the purpose of gambling in any place dedicated to Viṣṇu is considered to be a pious and meritorious act at this season. The Vaishṇava friars known generically as *Bairāgis* minister at most of the Vaishṇava shrines and festivals and acknowledge the spiritual supremacy of the chief of the S'rīranga temple and *maṭha* near Trichinopoly in the Madras Presidency.

The *Kārttika Māhātmya* of the *Pādma-Purāṇa* is devoted to a de-

scription of the rites and ceremonies to be observed during *Kārttik*. "In this month whatever gifts are made, whatever observances are practised, if they be in honour of Vishṇu, are sure of obtaining the end desired and realizing an imperishable reward." The first day of the light half is devoted to the memory of the *Daitya Rāja* Bali who was subdued by Vishṇu in his dwarf incarnation and to *Kṛishṇa* or *Kanhaiyā* as *Gobardhan*. When Bali was sent to *Pátāla*, he was allowed as a boon to have this day held sacred in his honour. The door-step is smeared with cow-dung and the images of Bali and his family are rudely drawn thereon and receive domestic worship. The second is known as the *Yama-dvitiyā* when *Yama* came down to visit his sister *Yamunā* and she received the boon that all brothers who visited sisters on that day and interchanged presents should escape hell. On the eighth a commercial fair is held at *Askot*. The ninth is known as the *Kushmāṇḍa-navamī* when pumpkins are offered to *Dēvī*, and on the eleventh called the *Hari-bodhinī*, the waking of Vishṇu from his periodical slumbers, is celebrated. The fourteenth is known as the *Vaikuṇṭha-chaturdaśī*, for he who dies on this day goes straight to the paradise of Vishṇu. Noted festivals are held on the *Vaikuṇṭha* fourteenth at *Kamaleśwara* in *Srinagar* and *Malik Arjun* in *Askot*. The day of the light half or *pūrṇimā* is like the *pūrṇimā* of *Baisākh*, a great day for bathing, and special assemblies are then held at the temples of *Pinākeśwara*, *Gaṇanātha*, *Sitēśwara*, *Vāsukī Rāja* and *Nāgadeva Padamgīr*.

Mangsīr.—The eleventh of the dark half of *Mangsīr* is known as the *Utpatti-ekādaśī*, but is not particularly observed. The eleventh of the light half is called the *Moksha-ekādaśī* and has some local celebrity. The twelfth or *Bārāhī dvādaśī* is so called in remembrance of Vishṇu's boar incarnation. The day of the full moon has no peculiar observance attached to it. The only other festivals during this month are those held at the harvest feasts. No important agricultural operation takes place without the intervention of some religious observance. An astrologer is called in who fixes the auspicious day, generally with reference to the initial letter of the name of the owner of the field, but if this does not suit, his brother or some near relation whose name is more convenient for the purpose takes the owner's place in the ceremony. Tuesdays and Saturdays are generally considered unlucky days. On the day fixed for the commencement of ploughing the ceremonies known as *kudkhyo* and *hālkhyo* take place. The *kudkhyo* takes place in the morning or evening and begins by lighting a lamp before the household deity and offering rice, flowers and balls made of turmeric, borax and lemon-juice called *pīṭya*. The conch is then sounded and the owner of the field or relative whose lucky day it is takes three or four pounds of seed from a basin and carries it to the edge of the field prepared for its reception. He then

scrapes a portion of the earth with a *kūṭhala* (whence the name *kudkhyo*) and sows a portion. One to five lamps are then placed on the ground and the surplus seed is given away. At the *halkhyo* ceremony, the *pitya* are placed on the ploughman, plough and plough-cattle, and four or five furrows are ploughed and sown and the farm-servants are fed. The beginning of the harvest is celebrated by the *kalái*, when ten or twelve ears of the new grain are brought from the fields and offered to the household deity. Pots of cow-dung are placed over the doorway and near the household deity, and four ears crossed two by two are placed in them. After the harvest is over one or two *śúrpa*s or sieves of grain are distributed amongst the servants. All these ceremonies are accompanied by simple prayer for prosperity in general and on the work about to be performed in particular.

Pús. Mán.—The eleventh of the dark half of Pús is called the *Saphala ekáulási*, and the eleventh of the light half is known as the *Bhojantí ekáulási*. The fourth of the dark of half of Mán or Mágh is known as the *Sankashṭa chaturthí*, which like the similarly named day in Bhádo is sacred to Gaṇeśa. The eleventh is the *Shaṭ-tila ekáulási* when the devout are allowed but six grains of sesamum seed as food for the whole day. The fifth of the light half called the *S'ri* or *Vasanta-panchamí* marks in popular use the commencement of the season of the Holi. The name '*S'ri*' is derived from one of the titles of Lakshmi, the goddess of wealth and prosperity, and according to some includes Sarasvatí, the goddess of learning. Even in Kumaon where the customs and ideas of the plains have not yet thoroughly permeated the masses, amongst some classes, young children beginning to learn are taught to honour Sarasvatí on this day, whilst the Baniyá worships his scales, the soldier his weapon, the clerk his pen, the ploughman his plough, and others the principal emblem of their professions or callings. The name *Vasanta-panchamí* connects the festival with the advent of spring and the young shoots of barley, at this time a few inches in length, are taken up and worn in the head-dress. The *Vasanta-panchamí* corresponds closely with the old Latin feast, the fifth of the ides of February which was fixed as the beginning of spring in the Roman calendar. On this day, people wear clothes of a yellow colour in honour of spring and indulge in feasts and visiting their friends. From the fourth to the eighth of the light half of Mágh festivals are held which are known collectively as the *Puncha parva*: they are the *Gaṇeśa-chaturthí*, the *Vasanta-panchamí*, the *Súrya-shashṭhí*, the *Achalá saptamí* and the *Bhishmāshṭamí*. The *Gaṇeśa-chaturthí* is observed by few in Kumaon, but the *Vasanta-panchamí* is held in honour all over the two districts. The *Súrya-shashṭhí* is held on the same day as the *Sítala-shashṭhí* of the plains, but has no connection with it. Here

it is observed by the Sauras only or occasionally old widows and others similarly situated who worship the sun on this day. The only noted festival in connection with it is that at the temple of the sun at Paban or Pabhain in Bel. The *Achalá saptamí* or "immoveable seventh," so called because it is said to be always held sacred, is seldom observed here. It is also called the *Jayantí-saptamí* or 'seventh of victory,' and festivals are held on this day at the Kamaleswara temple in Srinagar and the temple to Jayantí at Jayakoṭ in Boṛárau. The *Dhíshmáshṭamí* seems to be altogether unobserved, if we except the entirely local ceremonies held in some few places and utterly unknown to the people at large. The eleventh is known as the *Bhíma ekádaśí*, and this and the full moon are very seldom observed.

Phágun. S'ivarátri.—The eleventh of the dark half of Phágun is called the *Vijaya-ekádaśí* or 'eleventh of victory.' The fourteenth is everywhere sacred to S'iva. This is the day when all sins are expiated and exemption from metempsychosis is obtained. It is the anniversary of the apparition of the ling which descended from heaven to confound the rival disputants, Brahma and Vishṇu, a scene which is described at length in the Lainga Puráṇa.* The day preceding is devoted by the pious and educated to fasting, and all night long the deity is worshipped, and it is not until ablutions are performed next morning and offerings are made to the idol and the attendant priests, that the worshippers are allowed to eat. The day is then kept as a holiday. In the great S'aiva establishments the ceremonies are conducted with great splendour and are held to be especially sacred on this day, more particularly in those which were established before the Muhammadan invasion of India. These temples as enumerated by the local pandits are as follows:—(1) Rámeswara near Cape Komorin; (2) Kedárnátha in Garhwál; (3) Mahákála in Ujjain; (4) Somanátha in Gujrat; (5) Mallikárijuna in the Karnatic; (6) Bhíma Sankara near Púna; (7) Onkáranátha on the Nerbudda; (8) Viśvanátha in Benares; (9) Bhuvanésvara in Orissa; (10) Vaidyanátha in Bombay; (11) Bágeswara in Kumaon and (12) Jágeswara in Kumaon. As a rule, however, there is only a single service in some temple or a ling is made of clay and worshipped at home. The elaborate ritual laid down in the *Várshika pustaka*, the authority in these hills is very seldom observed: the mass of the people neither now understand it nor have they the means to pay the fees of the hereditary expounders. The ordinary ceremonies include the offering of rape-seed and uncooked rice with flowers and water, and then the mystical formula known as *práṇḍyáma* which is explained hereafter.

At the *mahápújá* on the S'ivarátri at Jágeswara the idol is bathed in

* Translated in Muir, IV., 388.

succession with milk, curds, ghi, honey and sugar: cold and hot water being used alternately between each bathing. Each bathing has its appropriate invocation, prayer and offering which are in all respects the same as those prescribed in the plains.* Another form of worship is the 'jap' or recitation of the one hundred and eight names of S'iva, such as Rudra, Isána, Hara, Paśupati, &c. These are counted off on a rosary made of the seeds of the *rudráksha* (*Abrus precatorius*). As a rule, however, few remember this litany and the worshipper is satisfied by repeating a single name as often as he cares, thus "Om śiváya om" or "Om mahádeo" is the favourite ejaculation of the 'jap' in Kumaon though one occasionally hears from pilgrims from the plains 'Har, Har Mahádeo, bam Mahádeo.' The leaves of the *bel* (*Ægle marmelos*) and the flowers of the *datúra* (*Datura alba*), the *kapúr nali* or *kapúr nai* (*Hedychium spicatum*), the *játi* or *jai* (*Murraya exotica*?) and the rose are specially sacred to S'iva and form a part of the *argha* or offerings made during his worship. There can be no doubt but that the present system of S'aiva worship though popular and universal is of modern origin, and on this point we may cite the testimony of Professor Wilson :†—"Notwithstanding the reputed sanctity of the *S'ivarátri*, it is evidently sectarian and comparatively modern, as well as a merely local institution, and consequently offers no points of analogy to the practices of antiquity. It is said in the *Kalpa Druma* that two of the mantras are from the *Rig Veda*, but they are not cited, and it may be well doubted if any of the *Vedas* recognise any such worship of S'iva. The great authorities for it are the *Puráṇas*, and the *Tantras*; the former—the S'aiva, *Laṅga*, *Pádma*, *Mátsya* and *Váyu*—are quoted chiefly for the general enunciations of the efficacy of the rite, and the great rewards attending its performance: the latter for the mantras: the use of mystical formulæ, of mysterious letters and syllables, and the practice of *Nyása* and other absurd gesticulations being derived mostly, if not exclusively, from them; as the *Isána Saṃhitá*, the *S'iva Rahasya*, the *Rudra Yámala*, *Mantra-mahodadhí* and other *Tántrika* works. The age of these compositions is unquestionably not very remote, and the ceremonies for which they are the only authorities can have no claims to be considered as parts of the primitive system. This does not impair the popularity of the rite, and the importance attached to it is evinced by the copious details which are given by the compilers of the *Títhi-Tattva* and *Kalpa Druma* regarding it and by the manner in which it is observed in all parts of India."

* See Wilson, II., 214: the prayers there given are paraphrased in the *Vārshika pustaka*.

† *Ibid.*, 219.

Gosāins.—The Gosāins* founded by S'ankara Āchārya are still a powerful body in these hills. S'ankara Āchārya had four principal disciples who are usually named Padmapāda, Hastāmālaka, Suresvara or Mandana, and Trōṭaka. Of these the first had two pupils, Tīrtha and Āsrama; the second had also two, Vana and Aranya; the third had three, Sārasvatī, Purī and Bhāratī, and the fourth had three, Gīr or Gīri, Pār-vata and Sāgara. These pupils became the heads of the order of Daśa-nāmī Daṇḍins or 'ten-named mentlicants,' and any one joining the fraternity adopts one of the names. Formerly all supported themselves by alms and wore celibates. Now some have married and become householders or have taken to trade or arms as a profession and are not acknowledged as brethren except perhaps in western India. The Gosāins proper are called Daṇḍins from the *daṇḍa* or staff carried by them in their travels. They are ruled by an assembly called the Daśanāma, composed of representatives of the ten divisions which has complete control over all the *maṭhas* of the order. On the death of a Mahant his successor is usually elected by the members of the *maṭha* to which he belonged or, in some cases, the *chela* or pupil succeeds. The chief *maṭha* of the order represented in Garhwāl is at Sringerī on the Tungabhadra river in the Madras Presidency. They serve at Rudranātha, Kalpeśwara, Kamaleśwara, Bhil-kedar, and indeed most of the principal temples dedicated to Ś'iva.

Jāngamas.—The Jāngamas or Lingadhārīs, so called from their wearing a miniature linga on their breast or arm, acknowledge the spiritual supremacy of Basava, minister of Bijjala Deva Kalachurī Rāja of Kalyāna and who murdered his master in 1135 A. D. Basava wrote the Bāsava-Purāṇa and his nephew, the Channa-Bāsava Purāṇa, which are still the great authorities of the sect. The name Basava is a Kānarese corruption of the Sanskrit '*vrishabha*,' and the Bāsava-Purāṇa is written in praise of the bull Nandī, the companion and servant of Ś'iva. The Jāngamas style themselves Puritan followers of Ś'iva under the form of a linga and call all others idolators. They say that they reverence the Vēdas and the writings of S'ankara Āchārya, but they reject the Mahābhārata, Rāmāyaṇa and Bhāgavata as the invention of Brāhmins. They consider both Sankara Āchārya and Basava to have been emanations of Ś'iva. Basava himself was a Śaiva Brāhman and devoted himself to the worship of Ś'iva under the form of a linga as the one god approachable by all. He denounced the Brāhmins as worshippers of many gods, goddesses, deified mortals and even of cows, monkeys, rats, and snakes. He denied the use of fasts and penances, pilgrimages, sacrifices, rosaries and holy-water. He set aside the Vēdas as the supreme authority and taught that all

* The name is derived according to some from 'go,' passion, and 'śvānt,' master: he who has his passions under control.

human beings are equal, and hence men of all castes and even women can become spiritual guides amongst the Jángamas. Marriage is imperative with Bráhmans, but permissive only with the followers of Basava. Child-marriage is unknown and betrothal in childhood unnecessary. Polygamy is permissible with the consent of a childless wife. A widow is treated with respect and may marry again, though whilst a widow she may not retain the jacket, perfumes, paints, black glass armlets, nose and toe rings which form the peculiar garb of the married woman. A Ján-gam always returns a woman's salutation and only a breach of chastity can cause her to lose her position. The Jángamas are also called Vira Saivas to distinguish them from the Arádhya, another division of the followers of Basava who call themselves descendants of Bráhmans and could not be induced to lay aside the Bráhmanical thread, the rite of assuming which requires the recital of the *gáyatrí* or hymn to the sun : hence the Jángamas regard this section as idolators and reject their assistance. Those who totally reject the authority of Bráhmans are called Sáurányas and Viśeshas. The Sámánya or ordinary Jángama may eat and drink wine and betel and may eat in any one's house, but can marry only in his own caste. The Viśesha is the guru or spiritual preceptor of the rest. The lesser vows are addressed to the linga, the guru and the Ján-gama or brother in the faith. The linga represents the deity and the guru he who breathes the sacred spell into the ear and makes the neophyte one with the deity : hence he is revered above the natural parents. The lingas in temples are fixed there and therefore called *sthávira* : hence the lingas of Basava are called *jángama* or able to move about, and the followers Jángamas or living incarnations of the linga. The Arádhya retain as much of the Bráhmanical ceremonial as possible, they look down on women and admit no proselytes, they call themselves Vaidikas and say that the Jángamas are Vedabáhyas. The latter declare that every one has a right to read the Vedas for himself and that the Arádhya are poor blind leaders of the blind who have wrested the scriptures to the destruction of themselves and others.

The Jángama worships Śiva as Sadásiva, the form found in Kedár, who is invisible, but pervades all nature. By him the linga is revered as a reliquary and brings no impure thought. He abhors Máya or Kálí who is one with Yona, and is opposed to licentiousness in morals or manners. He aims at release from fleshly lusts by restraining the passions ; he attends to the rules regarding funerals, marriage and the placing of infants in the creed, and is, as a rule, decent, sober and devout. Burial is substituted for cremation and Bráhmans are set aside as priests. The Vira-Saivas illustrate their creed by the following allegory :—‘ The guru is the cow whose mouth is the fellow-worshipper and whose udder

is the *linga*. The cow confers benefits by means of its udder, but this is filled through the mouth and body, and therefore if a *Vīra-S'āiva* desires the image to benefit him, he must feed the mouth, or in other words sustain and comfort his fellow-worshippers, and then the blessing will be conveyed to him through the teacher.* When the *Brāhmanical S'iva* is mentioned in their books it is only to show that the true *Vīra-S'āivas* are more than a match for the *Bhū-suras* or gods of the earth as the *Brāhmins* style themselves. The ordinary *S'āiva* temples are in some cases served by orthodox *Smārta* (*S'āiva*) *Brāhmins*. The *Jāngamas* still serve some of the principal temples in *Garhwāl*.*

Kānpḥatās.—The *Kānpḥatā Jogīs* conduct the worship in all the *Bhairava* temples that are not ministered to by *Khaśiyas*. Their principal seat is at *Danodhar* on the edge of the *Raṇ* of *Kachh* about twenty miles north-west of *Bhūj* in the *Bombay Presidency*. They wear brick-dust coloured garments and are remarkable for the large earrings of rhinoceros horn, agate or gold worn by them and from which they are named. They are very numerous in these hills and possess several large establishments. They follow the *Tāntrika* ritual, which is distinguished by its licentiousness for both the *linga* and the *yona* are worshipped by them, and they declare that it is unnecessary to restrain the passions to arrive at release from metempsychosis. They are the principal priests of the lower *S'akti* forms of *Bhairava* and even of the village gods, and eat flesh and drink wine and indulge in the orgies of the left-handed sect. Departing from the original idea of the female being only the personified energy of the male, she is made herself the entire manifestation and, as we shall see in the case of *Durgā*, receives personal worship, to which that of the corresponding male deity is almost always subordinate. The *S'āktas* are divided into two great classes, both of which are represented in these districts, the *Dakṣiṇāchārīs* and *Vāmāchārīs*. The first comprise those who follow the right hand or open orthodox ritual of the *Purāṇas* in their worship of *S'akti*, whilst the latter or left-hand branch adopt a secret ceremonial which they do not care openly to avow. The distinction between the two classes is not so apparent in the mass of the *S'āktas*

* The chief authorities for the *Lingāyat* system are :—

The *Bāsava-Purāṇa* of the *Lingāyats* translated by the Rev. G. Würth, J. B. B. R. A. S., VIII., 63.

The *Channa-Bāsava Purāṇa* translated by the same. *Ibid.*

The creeds, customs and literature of the *Jāngamas*, by C. P. Brown, M. J. L. S. XI. 143 : J. R. A. S., V n. s. 141. •

The *Bāsava-Purāṇa*, the principal book of the *Jāngamas*, by the same. *Ibid.*, XII. 193.

On the *Gosāins* by J. Wardem, M. J. L. S. XIV. 67.

Castes of *Malabar*. *Ibid.*, 1878, p. 172.

here as amongst the extreme of either class. The more respectable and intelligent, whatever their practice in secret may be, never profess in public any attachment to the grosser ceremonial of the left-hand S'áktas, and it is only fair to say that they generally reprobate it as opposed to the spirit of the more orthodox writings. As a rule, the worshipper simply offers up a prayer and on great occasions presents one, two, five or eight kids, which are slaughtered and afterwards form the consecrated food of which all may partake. The left-hand ritual is more common in Garhwál, where there are some sixty-five temples dedicated to Nágaraája and Bhairava and some sixty dedicated to Bhairava alone, whilst there are not twenty temples to these forms in Kumaon. Nágaraája is supposed to represent Vishnu, and Bhairava is held to be a form of S'iva, and these with their personified energies are considered present in each of these temples, though in the actual ceremony the worship is chiefly directed to the female form of S'iva's S'akti. In all the rites, the use of some or all the elements of the five-fold *makára*, viz., *matsya* (fish), *mámśa* (flesh), *madya* (wine), *maithuná* (women) and *mudrá* (certain mystical gesticulations), are prescribed. Each step in the service is accompanied by its appropriate mantra in imitation of those used with the five-fold offerings of the regular services. In the great service of the *Srī Chakra* or *Pūrṇābhisheka*,* the ritual, as laid down in the *Dasakarma*, places the worshippers, male and female, in a circle around the officiating priest as representatives of the Bhairavas and Bhairavis. The priest then brings in a naked woman, to whom offerings are made as the living representative of S'akti, and the ceremony ends in orgies which may be better imagined than described. It is not therefore astonishing that temple priests are, as a rule, regarded as a degraded, impure class, cloaking debauchery and the indulgence in wine, women and flesh under the name of religion. Garhwál is more frequented by pilgrims and wandering religious mendicants, and this is given as a reason for the more frequent public exhibition of their ceremonies there. In Kumaon the custom exists, but it is generally observed in secret, and none but the initiated are admitted even to the public ceremonies. The Tantras prescribe for the private ceremony that a worshipper may take:—"a dancing-girl, a prostitute, a female devotee, a washerwoman or a barber's wife," and seating her before him naked, go through the various rites and partake with her of the five-fold *makára*.

Sacrifices.—The *bali-dána* or oblation when offered by Vaishnavas consists of curds, grain, fruits and flowers, but when offered by the S'aiva S'áktas here usually assumes the form of living victims, the young of

* See for further details Wilson, I., 258, and Ward, III, 194, ed. 1822: the descriptions there given fairly represent the practice in the hills.

buffaloes or more generally of goats. At Purnagiri in Tallades, Hát in Gangoli and Ranchula Koṭ in Katyúr, the consort of S'iva, in her most terrible form, has attained an unenviable notoriety as having been in former times appeased by human sacrifices. In the neighbouring country of Nepál,* it is recorded that the custom of offering human sacrifices to Bachhlá Deví, another form of Kálí, was introduced by S'iva-deva-varma, and that when one of his successors, Viśva-deva-varma, considered it a piece of great cruelty and desired to abolish it "Nara-siva made a great noise. Whereupon the Rája went to see what was the matter and the Nara-siva came to seize him. The Rája, being pleased at this, gave him a large *jágúr* which remains to the present day." In Bhavabhúti's charming drama of Málátí and Mádhava we have an account of the attempt made by Aghoraghanṭa to offer Málátí as a sacrifice to Chámuṇḍá Deví when she is rescued by Mádhava.† In the collection of legends known as the Kathá-sarit-ságara frequent mention is made of the sacrifice of human victims by the barbarous tribes inhabiting the forests and mountains and we know that up to the present day the practice has existed amongst the wild tribes in Khondistán. In the Daśa Kumára Charitra, also, we are told of Praháravarma, Rája of Mithila, being attacked by the S'avaras and losing two of his children who were about to be offered by the barbarians to Chaṇḍí Deví when they were fortunately rescued by a Bráhmaṇ. The Kálíka Purāṇa, too, gives minute directions for the offering of a human being to Kálí, whom, it is said, his blood satisfies for a thousand years. Both at Purnagiri and Hát a connection and oneness with the great Kálí of Calcutta is asserted and cocoanuts are much esteemed as a subsidiary oblation. In the latter place the sacrificial weapon used in the human sacrifices is still preserved.‡

Holí.—The Holí commences on the eighth or ninth and ends on the last day of Phálgun *Sudi*, locally known as the *chhararí* day. Some derive the name Holí from the demon Holiká, who is one with Pútana; but the *Bhavishyottara Purāṇa*, which has a whole section devoted to this festival, gives a different account which may be thus briefly summarised:—In the time of Yuddhishtíra there was a Rája named Raghu who governed so wisely that his people were always happy, until one day the Rákshasí Dundhá came and troubled them and their children. They

* Wright's Nepal, 126, 130: Sivadeva lived about the tenth century.

† Wilson, XII, 58.

‡ Those who are desirous of investigating the subject of human sacrifices further are referred to Wilson's works, I, 264; II, 247; III, 353; IV., 143; Max Müller's History of ancient Sanskrit Literature, 408; Muir's Sanskrit Texts, I., 355; II., 184; IV., 289; Wheeler's History of India, I, 403; Wilson's India, 68, and Colebrooke's Essays 34.

prayed the Rája to aid them and he consulted the Muni Nárada, who directed them to go forth in full confidence on the last day of the light half of Phálgun and laugh, sport and rejoice. Then they should set up a bonfire and circumambulate it according to rule, then every one should "utter without fear whatever comes into his mind. In various ways and in their own speech let them freely indulge their tongues and sing and sing again a thousand times whatever songs they will. Appalled by those vociferations, by the oblations to fire and by the laughter of the children," the Rákshasí was to be destroyed. "Inasmuch as the oblation of fire (*homa*) offered by the Bráhmans upon this day effaces sin and confers peace upon the world (*loka*), therefore shall the day be called *holiká*." The Kumaonis take full advantage of the license thus afforded and under the influence of *bháng* proceed from village to village singing obscene songs and telling stories. The red-powder or *gulál* which is used in the sports during the festival is made from the flowers of the rhododendron. Although preparations commence on the eighth or ninth, the real festival does not begin until the eleventh, known as the *chirbandan* day, or *amardakí ekádaśí*. On this day, people take two small pieces of cloth from each house, one white and the other coloured, and after offering them before the S'akti of Bhairava make use of them thus:—A pole is taken and split at the top so as to admit of two sticks being placed transversely at right angles to each other and from these the pieces of cotton are suspended. The pole is then planted on a level piece of ground, and the people, singing the Holí songs in honour of Kanhaiyá and his Gopís, circumambulate the pole and burn it on the last day. This ceremony is observed by the castes who assume connection with the plains castes, but the lower class of Khasíyas, where they observe the festival, simply set up the triangular standard crowned by an iron trident, the special emblem of Paśupati, which they also use at marriage ceremonies. The Holí is chiefly observed in the lower paṭṭis and is unknown in the upper hills. The *Tiká* holí takes place two days after the *chhararí* or last day of the Holí, when thankofferings are made, according to ability, on account of the birth of a child, a marriage or any other good fortune. The expenses of these festivals are usually met by a cess on each house which is presented to the officiating Bráhman for his services, and he, in return, gives to each person the *tilak* or frontal mark, made from a compound of turmeric. The practice of the orthodox and educated in no way differs from that current in the plains. The Holí is clearly another of those non-Bráhmanical ceremonies connected with the montane Paśupata cult which have survived to the present day.

Festivals regulated by the solar calendar.—Each *sankránta* or the passage of the sun from one constellation into another is marked by festi-

vals. Most of the Bhairava temples in Garhwál and even such as Narmadeśwara, Vṛiddha Kedára and Náráyana have special assemblies on every *sankránta* throughout the year, whilst others hold special services only on particular *sankrántas*, such as the Bikh, Mekh and Makar. Generally the festivals of the village deities as well as all civil duties and engagements are regulated by the calendar for the solar year.

Mín sankránta.—The *Mín* or *Chait sankránta* is not generally observed; but on the following day, girls under nine years of age and boys who have not yet been invested with the sacrificial thread (*janeó*) visit their relations, to whom they offer flowers and smear rice coloured with turmeric (*haldi*) on the threshold of their doors: hence the name *Hal-duwá sankránta*. In return, the children receive food and clothing. The low castes Hurkiyá and Dholí, the dancers and musicians of the hills, also, go about from village to village during the whole of this month, singing and dancing and receive in return presents of clothes, food and money.

Bikh sankránta.—The *Mekh* or *Baisákh sankránta* is also called the *Vishapadi*, *Bikhpadi*, *Vijoti*, *Vikhoti* or *Bikh sankránta*. On this day, an iron rod is heated and applied to the navels of children in order to drive out the poison (*bikh*) caused by windy colic and hence the local name *Bikh sankránta*. It is a great day of rejoicing for both Śaivas and Vaishnavas and fairs are held at the shrines of Umá at Karpaprayág, Sítéśwara in Kota, Tunganátha, Rudranátha, Gauri, Jwálapá, Káli, Chandiká, &c., as well as at Badrináth, Vishnuprayág, Dhyánbadrí and the temples of Náráyana and Ráma. Most of the more important temples have special services on the *Bikh* and *Makar sankrántas*. The latter represents the old computation by which the entrance of the sun into the sign of Capricorn was considered the commencement of the new year and the former the new system by which the entrance of the sun into the sign *Mesha* or Aries begins the new year: hence both days are held sacred throughout both districts. I have not noticed that any special festival is held on the *Brish* or *Jeth sankránta* or on the *Mithun* or *Asárh sankránta* except one, on the latter date, at the Kailás hill above Bhím Tál, though, as already noted, there are numerous temples where services are held on every *sankránta* throughout the year.

Kark sankránta. *Bagwáli*.—The *Kark sankránta* is known also as the *Harela*, *Hariyálo* or *Harýáo sankránta* from the following custom:—On the 24th *Asárh*, the cultivators sow barley, maize, pulse (*gahat*) or mustard (*lai*) in a basket of earth and on the last day of the month, they place amidst the new sprouts small clay images of Mahádeva and Párvatí and worship them in remembrance of the marriage of those deities. On the following day or the *Kark sankránta*, they cut down the green stems

and wear them in their head-dress and hence the name *Harela*. The *Kark sankránta* was the great day of the *bagwáli* or stone-throwing festival for Chamdyol in Paṭṭi Gumdes, Rámgar in Paṭṭi Rámgar, at the Náráyani temple in Siloti and at Bhím Tál in Chhakháta. It was also held at Ďebí Dhúra on the full moon of S'aun, at Champáwat, Patuá in Súi and Siyál De Pokhar in Dwára on *Bhayya dúj* or Kárttik Sudi 2nd. The *bagwáli* was known as the *siti* in Nepál* and is said to have been established there at a very early period by Rája Guṇakáma Deva, who received in a dream a command to that effect from Srí Skandaswámí, the god of war. He appears to have revived the custom of the *kilátari* game which was introduced by Bhuktamána, the founder of the Gwála dynasty, as a portion of the games held in the S'leshmántak forest, sacred to the Paśupati form of S'iva. Guṇakáma drew up strict rules for the conduct of the fray which were at first carried out with the greatest rigour, and the prisoners captured on either side were offered as sacrifices to Deví. The game was played from Joṭh to Siti-shasṭi, and though the murder of the prisoners soon fell into abeyance, many grievous accidents occurred until at length the custom was abolished by Sir Jung Bahádúr on account of Mr. Colvin, the Resident, having been struck by a stone whilst looking on. In these districts it was the custom for several villages to unite and defend the passage across a river against a similar force from the other side. As the hill-men are good slingers injuries occurred and even fatal accidents, so that the custom was prohibited, and now the combatants amuse themselves merely by pelting stones at some boulder or conspicuous tree. In Juhár, the Bhoṭiyas offer a goat, a pig, a buffalo, a cock and a pumpkin† which they call *pancha bali* to the village god, on the *kark sankránta*. The day is given up to feasting and drinking spirits and towards evening they take a dog and make him drunk with spirits and bhang or hemp, and having fed him with sweetmeats, lead him round the village and let him loose. They then chase and kill him with sticks and stones and believe that by so doing no disease or misfortune will visit the village during the year. The festivals on this day at Báleswar in Čhárál, and at Dhernáth in Súi Bisang, are attended by all the neighbouring villagers.

Bhado sankránta.—The *Sinha* or *Bhado sankránta* is also locally known as the *Ghí* or *Ghyúshgyán sankránta*, because on this day even the poorest classes eat *ghí* or clarified butter, and has the name *Walgiya* because curds and vegetables are then offered by all persons to those in authority over them. There is a fair on this day at the temple of Vaishnaví Deví at Naikuni in Seti.

* Wright, 108, 156.

† *Kumila* or *petha*, Cucurbita pepo (Roxb.).

Kanyá sankránta.—The *Kanyá* or *Asoj sankránta* is also locally known as the *Khataruwá sankránta* from the people gathering hay and fuel on this day. From a portion of these firstfruits after the rains a bonfire is made into which the children throw cucumbers and flowers and make money by singing and dancing. The following story is told in explanation of this custom :—"In former days one of the Chand Rájás sent a force to invade Garhwál and gave strict injunctions to his general to convey speedily the news of any victory that should be gained. The general told the Rája that when he saw the hills around blazing with bonfires he might know that Garhwál had been conquered, and for this purpose heaps of fuel were collected on all the higher peaks along the line of march and placed under charge of guards. The object of the expedition was attained on the *Kanyá sankránta* and the fuel was fired and peak answered peak until in a few hours a bonfire was blazing on every hill from Garhwál to Almora. The Rája was so pleased at the success of his troops and the rapidity with which the news of the victory was communicated that he gave orders to continue the custom on each anniversary." Hence this custom has been observed ever since in Kumaon, but not in Garhwál.

Makar sankránta.—The *Makar* or *Mágh sankránta* is also known as the *Ghugutiya*, *Phúl*, and *Uttaráyini* or *Uttaraini sankránta*. The name '*Ghugutiya*' is given from the small images of flour baked in sesamum oil or *ghí* and made to resemble birds which are strung as necklaces and placed around the necks of children on this day. On the morrow or the second day of *Mágh* the children call the crows and other birds and feed them with the necklaces and eat a portion themselves. The name '*Phúl*' *sankránta* is derived from the custom of placing flowers, especially those of the rhododendron, at the threshold of friends and relations who, in return, give presents of rice and grain. The name '*Uttaráyini*' is derived from its being the beginning of the winter solstice according to the Hindú system and, as with us, commences with the entry of the sun into the sign Capricorn. The name '*Makarā*' is the Hindú equivalent for the constellation corresponding to Capricorn and is represented by a figure half fish and half goat. The whole of *Mágh* is specially devoted to the worship of Vishnu and the sun, and according to the *Pádma-Purána* bathing during this month is particularly efficacious. The great commercial fairs at Bageswar and Thal Baleswar are held on this day. Amongst the Sikhs, the *Makar sankránta* is the occasion of a fair at Rikhikés on the Ganges connected with the Dehra establishment. ..

Conclusion.—The general result of our brief survey of the religious festivals observed in Kumaon and Garhwál shows that even at the present day, they are in no sense of Bráhmanical origin. Excluding those clearly

borrowed from the plains and followed almost entirely only by the educated and wealthier classes, the really popular festivals are those held at the two harvests, those in honour of the Nágas at the Jeth Dasahra and Nágapanchamí, the great S'aiva S'akti observances on the Chait and Asoj *navarātris* and the festivals in honour of Bhairava, Nágarája, and the rural deities Goril, Ghaṇṭakarma, &c. The sacrifice of kids is a part of almost all the ceremonies on these occasions, young male buffaloes are also offered, and in former times human sacrifices were not uncommon at the temples of the dark form of the consort of S'iva. All these facts mark the non-Bráhmanical origin of the existing form of worship. The Khasiás of Kumaon possess many traits in common with the Dasyus of the Vedas, practically they have no Vedas, they perform no Vaidik ceremony and their sacrifices are not in accordance with any Vaidik ritual, their caste observances and rules as to eating and drinking are not on the same strict lines as those observed by the Hindús of the plains, and it was these distinctions that placed them fifteen hundred* years ago outside the pale of the twice-born, and which even under more liberal influences now outcasts them.

Domestic ritual.—We shall now consider the domestic ritual in use in Kumaon, premising that it is followed as a rule only by the educated and orthodox, and that its use has not yet permeated the masses, nor are its rules, except in a very abbreviated form, understood by many of them. The ritual for temple use has been compiled by a class for their own purposes and usually with the object of setting forth the preferential cult of some particular deity or of inculcating the tenets of some particular sect, and although the general outline of the ceremony is the same in all, the details vary considerably. The village-deities have no formal ritual committed to writing and in general use, so that the ceremony is a meagre imitation of that in use in the orthodox temples and varies with the celebrant. The authorized domestic ritual in use in Kumaon fairly represents the ceremonial observed by those who consider themselves one in faith with the orthodox Hindús of the plains. It will show no great divergence in ordinary ceremonies from the procedure observed in the plains, for which, however, I have not been able to procure an authority that could be relied upon. The work† consulted is the *Daśa-karmādi*

* Muir's Sansk. Texts. II, 412, 482.

† The copy used by me contains the preparatory ceremonies (pp. 1-28); those held on the birth of a son (pp. 29-61); those on his assuming the sacrificial thread (pp. 69-132), and those on marriage (pp. 150-205), besides other services for special occasions. This work has since been lithographed. I have not considered it necessary to give many of the *mantras* at full length for any one can verify them by asking any intelligent Bráhman for them and giving the catchwords recorded here. It may be well to notice that the Sanskrit employed is sometimes barbarous in the extreme (= dog Latin), but I give it faithfully.

paddhati, or 'Manual of the ten rites, &c.,' which is held in great esteem in this portion of the Himálaya. It gives the ritual to be observed on every occasion from the conception of the native until his marriage. Each ceremony has certain preparatory services common to all, and which occupy the first ten chapters of the Manual, viz. :—(1), *Svasti-váchana*; (2), *Gaṇeśa-pújá*; (3), *Mútri-pújá*; (4), *Nándi-śrákṣha*; (5), *Punyáha-váchana*; (6), *Kalaśa-sthápana*; (7), *Rakshá-vidhána*; (8), *Ghṛitachelkháyá*; (9), *Kuśa-kandiká*; and (10), *Kuśa-kandikopayogisangraha*. In practice, however, the ceremony is shortened by the omission of several of these services and, as a rule, the second, third and fourth chapters with the sixth and seventh are alone read. With regard to these and all other observances their length and character would seem to depend on the means and inclination of the person who causes the ceremony to be performed. The poor man obtains a very shortened service for his few coins, whilst the wealthy can command the entire ritual and the services of numerous and skilled celebrants. The rich can afford to keep Bráhmans in their employment who vicariously perform for them all the intricate and tedious ceremonies prescribed by the ritual and at once relieve their masters from a disagreeable duty and ensure for them the fruits of a devout life. It will be seen, however, that the earlier chapters form a necessary part of the ritual of every important ceremony and are repeated numbers of times at different stages. They are referred to hereafter as the 'preparatory ceremonies' and are closed with a *sankalpa* or dedication to the particular object in view at the time, so that the merit acquired by performing them may aid in the attainment of the object aimed at.

Daily prayers.—Before commencing an account of the ceremonies proper to particular objects and seasons it will be convenient to refer here to those known as *nitya karma* or obligatory, to be observed at morn, noon and eve. The necessities of every-day life, however, contrive that one recital before taking food, either in the morning or in the evening, shall be considered sufficient, and we shall now describe the morning service, which with a few slight changes serves for all. It need hardly be said that these are unknown to the ordinary Khasiya population, except here and there in a very diluted form. The usual morning routine is first gone through by drawing up the sacrificial thread and placing it on the left ear before retiring, next washing the teeth, bathing and applying the frontal marks with powdered sandal, or red sandars and rice.

Achamana.—The *santṛhyá* or office of domestic worship then commences and is opened by placing some water in the hollow of the right-hand from which a sup is taken (*achamana*) whilst mentally repeating the mantra :—'Om, to the Rig-veda, hail;' a second is then taken with

the words :—‘ *Oṃ*, to the Yajur-veda, hail :’ and a third with the words :—‘ *Oṃ*, to the Sāma-veda, hail.’ A fourth is then taken whilst repeating the formula :—‘ *Oṃ*, to the Atharva-veda, hail,’ and is rejected immediately on completing the invocation. The *choṭi* or tuft of hair left on the top of the head is then laid hold of whilst the following mantra is mentally repeated :—‘ Invoking the thousand names of Brahmā, the hundred names of the top-knot, the thousand names of Viṣṇu I tie my top-knot.’ The mouth is then cleansed by passing the thumb of the right hand over the moustache to each side from the parting.

Sparsa.—Then follows the sprinkling (*indriya sparsa*) of the mouth, nostrils, eyes, ears, navel, breast, throat, head, arms and palms, and back of the hands with water and the salutation ‘ *Oṃ* ’ prefixed to the name of each member* and mental prayer for its health and strength.

Abhisheka.—The worshipper then touches the ground with the third finger of his right-hand whilst repeating the mantra :—“ O thou, who hast made this earth and all it contains and protectest all by thy power, make me pure.” Water is next taken in the hand whilst he mentally recites the mantra :—“ May any evil or trouble which is due to me this day be by thy power prevented.” This is followed by the first *abhisheka* or aspersion in which water is taken in the left hand and sprinkled with the right hand over each member as before with the purificatory mantra :—“ *Oṃ bhū*, protect my head ; *oṃ bhuvah*, protect my eyes ; *oṃ svah*, protect my throat ; *oṃ mahah*, protect my breast ; *oṃ jānah*, protect my navel ; *oṃ tapah*, protect my feet ; *oṃ satyam*, protect my head ; *oṃ kham*, Brahmā protect me everywhere.” This is known as the *pūrvakamārjjana-mantra*. Most of us have seen the natives of India at their devotions and have doubtless wondered what their meditations were and what the curious movements of the hands and muttered words intended. I am not aware that these have ever been the subject of inquiry, or that they have ever been recorded and explained in any European language, and now give the *prāṇāyāma* and its prefaces after a lengthened practice of them by myself.

Prāṇāyāma.—The *prāṇāyāma* occurs both in the daily prayers and in the short private devotions performed in temples and is always prefaced by the *āṅga-nyāsa* and *kara-nyāsa*. These consist of separate sets of salutations to the seven members of the body (*āṅga*) and to the seven members of the hand (*kara*), each of which is accompanied by a mystical mantra in which the deities of one of the seven worlds is saluted in order that they may come and take up their abode for the time in the member of the

* *Oṃ vāk*, *vāk* ; *Oṃ prāṇah*, *prāṇah* ; *Oṃ chakshu*, *chakshu* ; *Oṃ śrotram*, *śrotram* ; *Oṃ nābhīh* ; *Oṃ hridayam* ; *Oṃ kaṇṭham* ; *Oṃ sirah* ; *Oṃ bāhubhyāṃ yasobalam* ;

* *Oṃ karatala-karapriṣṭhe*.

worshipper dedicated to them. This formula will be better understood from the following table :—

The seven spheres of the	Sanskrit names.	Hindi equivalents.	Members of the hand.	Members of the body.
1. Earth	Bhūr-loka	Bhu	Thumb (<i>angushṭa</i>)	Chest (<i>hṛdaya</i>).
2. Sky	Bhuvār-loka	Bhuvar	Fore-finger (<i>tarjanā</i>).	Head (<i>śiras</i>).
3. Planets	Svar-loka	Sva	Second ditto (<i>madhyama</i>).	Scalp-lock (<i>śikhā</i>).
4. Saints	Maharloka	Maha	Third ditto (<i>anāmika</i>).	Throat (<i>kanṭha</i>).
5. Sons of Brahmā.	Jano-loka	Jana	Fourth ditto (<i>kanishṭhika</i>).	Eye (<i>netra</i>).
6. Penance	Tapo-loka	Tapas	Palm (<i>karatala</i>)	Navel (<i>grābhi</i>).
7. Truth	Satya-loka	Satyam	Back of the hand (<i>karapṛishṭa</i>).	Back (<i>pīṭh</i>).

The *kara-nyāsa* is first performed and is made by holding the nose by the right hand and placing the first finger of the left hand inside and against the middle joint of the thumb and drawing it gently to the top of the thumb whilst repeating mentally the *mantra* :—*Om bhūh angushṭābhyām namaḥ*. The second motion is made by drawing the thumb from the first joint of the forefinger to the top whilst repeating mentally the *mantra* :—*Bhuvah tarjanābhyām namaḥ*. The remaining motions are similar and for the second finger the *mantra* :—*Svah madhyamābhyām namaḥ* is repeated; for the third :—*Tat savitur varenyam anāmikābhyām namaḥ*, and for the fourth :—*Bhargo devasya dhīmahi kanishṭhikābhyām namaḥ*. Then the palms and backs of the hands are touched whilst the *mantra* :—*Dhiyo yo naḥ prachodayāt karatala-karapṛishṭābhyām namaḥ* is repeated.

Anga-nyāsa.—The *anga-nyāsa* or mental assignment of the members of the body to the protection of the great mantras is as follows :—*Om bhūh*, glory to the heart; *bhuvah*, glory to the head; *svāhā* (hail); *svah*, to the top knot, *vashat* (here meaning hail); *tat savitur varenyam*, to the navel or the armour of the mantras, *hūm*; *bhargo devasya dhīmahi*, to the

* *Bhūr*, *bhuvah*, *svah*, are the three mystical words known as the *Vyāhṛiti mantra* and are untranslatable. The mantras here given simply mean 'Om, glory to the thumb': to the first finger and to the second finger, &c. The *gāyatrī* verso is then brought in and divided into three portions as a preface to the salutation to the remaining parts of the hand. In full it is 'Tat savitur varenyam bhargo devasya dhīmahi dhiyo yo naḥ prachodayāt' and occurs in *Rig-Veda*, III., 62, 10. From being addressed to the sun it is called *Sāvitrī* and is personified as a goddess. Hereafter we shall see that other verses also are called *gāyatrī*. In some cases both hands are used and the nose is not held by the right hand.

eyes, *vaushat*; *dhiyo yo naḥ prachodayāt*, to the weapon of the mantras, *phaṭ, phaṭ, phaṭ* accompanied by clapping the hands. Other gesticulations are bringing the right hand around the head and clapping the hands three times which is supposed to purify all beings; also snapping the thumb against the two fore-fingers thrice with appropriate mantras which bring the deity into one's self.

The earth, air and sky are represented by the mystic syllables *bhūr, bhuvah, svah*, whilst these again are held by some to represent the old trinity Agni, Indra and Sūrya, who even amongst the non-Bráhmānical tribes attained to considerable popularity. Again in the mystic word '*Om*' we have according to some A. U. M., representing the initial letters of the names of Agni, Varuna (a form of Indra) and Mitra (one with the sun): others refer these letters to Brahmá, Vishnu and Śiva, who comprise the *Tri-mūrti* of advanced Bráhmānism. A triad is also worshipped at the temple of Jagannátha in Orissa, the actual forms of which represent the double cursive form of '*Om*' as ordinarily written in manuscript, and that this is the true meaning of the form which those unnecessarily hideous blocks assume I have little doubt. In a note to his translation of the *Málatí* and *Mádhava* of Bhavabhūti, Professor Wilson* explains '*Nyása*' as "a form of gesticulation made with a short and mystic prayer to the heart, the head, the crown of the head and the eye, as *Om śirase namaḥ*, 'Om! salutation to the head'; with the addition of the *kavacha*, the armour or syllable *phaṭ*, and the *astra*, the weapon or syllable *hum*. The entire *mantra*, the prayer or incantation, is then '*Om śirase namaḥ, hum, phaṭ*.'" These formulæ were specially used by the sect of Yogis or Páśupatas, "the oldest sect probably now existing amongst the Hindus and with whose tenets and practices Bhavabhūti appears to have been thoroughly acquainted." Again Cunningham† in his *Ladák* gives the *mantra* addressed to the Bodhisattvas by the Buddhists of Tibet, taken from an actual Tibetan stereotype block, which ends with the line:—

'*Om Vajra-krodha, hāyagrīva, hulu, hulu, hum, phaṭ*.'

This important portion of the daily prayer is therefore clearly derivable from the non-Bráhmānical worship of deities which we shall show hereafter were probably of montane origin and common alike to the Śaiva and Bauddha systems.

Dhyána.—In the daily worship the *anga-nyása* is usually followed by the *dhyána* or *aghamarśhana* or meditation in which with clasped hands and closed eyes the celebrant mentally recites and considers the verses commencing:—*Om řitam cha satyaṃ chābhídhāt &c.* In Kumaon, the *prānyāma* is occasionally further prefaced by a short address (*chhandāh*)

* Works XII: 5, 11, 53.

† p. 386.

in the form of a *mantra* to the personified 'Om,' the Brahmarshis, Vaidik metres and the Supreme Being :—Water is taken from the receptacle in the hand whilst the address is mentally recited, after which the water is thrown away. The first motion of the *prāṇāyāma* is made by placing the fore-finger of the right-hand on the right nostril and exhaling with the other nostril whilst a mystical *mantra** is mentally repeated. This occurs three times whilst exhaling and three times whilst inhaling.

Abhisheka.—A second *abhisheka* or purificatory aspersion of the body generally takes place next with the *mantra* :—*Om āpo hishṭā mayo bhuvah snāna ūrjṇye, &c.* Then water is taken in the hand and applied to the nose with the *mantra* :—*Drupadād iva munuchāna sannasnāto malād iva hu pūtan pavitreṇa vāhyam āpaḥ śuddhantu, me nasaḥ.*

Anjali.—Next the *anjali* is performed in which water is taken in the hollow of both hands and whilst the *gāyatrī*-*mantra* is slowly recited the water is poured through the fingers on the ground. The celebrant should stand with his face towards the east whilst the verse is chaunted and should repeat it three times.

Upasthāna.—This is followed by the *upasthāna* or approaching the deity in worship in which the celebrant draws the fore-arms parallel to the body with the palms of the hands open and the thumbs on a level with the ears whilst the *mantra* is repeated :—*Om ulvayantamasas, &c.*

Next the head, navel, heart, top-knot and forehead are touched with appropriate *mantras*.† The sacrificial thread is then wound around the right-hand three times whilst the *gāyatrī* is repeated either 8 or 10 or 28 or 108 or 1,000 times according to the inclination of the worshiper. Water is again taken in the hand and if the *gāyatrī* has been repeated a fixed number of times, the morning's devotion ends with the formula :—*Brahmā svarīpiṇe Jhagavan prīto'stu*; if at mid-day, with *Vishṇu, &c.*, and if at evening with *Rudra, &c.*, whatever the number may be. Where no account of the number of times is kept the conclusion‡ is :—"O Lord, the treasure of mercy, through whose compassionate goodness whatever is worthy in my devotions is accounted for righteousness, may the four objects of existence (religious merit, wealth, pleasure and final emancipation) be attained by me this day." Whilst these prayers are being repeated the water is allowed to trickle slowly on to the ground. The

* *Om bhūh, om bhuvah, om svah, om mahah, om janah, om tapah, om satyam, tat savitur varenyam bhargo devasya dhīmahi dhiyo yo nah prachodayāt apo jyoti raso 'mritam brahma bhūr bhuvah svaram.* A mixture of the *vyāhṛiti* and *gāyatrī* mantras with some additions.

† *Agmīr mukhe, brahmā hṛdaye, viṣṇuḥ śikhāyām, rudro lalṛte.*

‡ *He īṣvara dayānidhe bhavatkṛipayānena japopāsāndi-karmanā dharmārthakāmamokṣhānāṃ sādhyasiddhir bhaven naḥ.*

sanlhyá closes with the *danḍavat* or salutation* and the *áčhamana* or rinsing of the mouth as in the beginning.

Seasti-váchana.—The *Seasti-váchana* is seldom read by any class in Kumaon. It opens with the direction that the celebrant should at an auspicious moment bathe, put on clean clothes, affix the frontal mark and seated with his face towards the east in a properly prepared place, recite the invocation of blessings.† The *Gaṇeśa-pújá* follows and is universally observed on all occasions as the *pradhána-anga* or leading section of every rite. The rubric directs that the celebrant should rise early on the morning of the ceremony and having bathed and put on clean clothes should, after performing the *nitya-karma*‡, light a lamp and commence the worship of Gaṇeśa, which should precede every other rite.

Gaṇeśa-pújá.—First adore Vishṇu with the following verse:—
“Thou who art clothed in white, moon-coloured, four armed, of pleasing face, the remover of obstructions, the bestower of good fortune and victory, what can oppose thee Janárdana, of the colour of the lotus, who dwellest in the hearts of thy votaries.” Next follows the adoration of Gaṇeśa with the verse:—“*O Vakratuṇḍa*, great-bodied, bright like a knot of suns, protect me from harm, O God, always in every work.”

Argha-sthápana.—Then the ceremony known as *argha-sthápana* or consecrating the *argha*§ takes place. Take some powdered sandal-wood and draw on the ground the figure of a triangle and around it a square and again a circle, then place on them sandal, rice and flowers. Next place the *argha* filled with water in the middle and say:—“In this water may the waters of the Gangá, Jamuná, Godávarí, Sárasvatí, Narmadá, Sindhu and Káverí be present.” Next put sandal, rice and flowers in the water of the *argha*. Then set up a brazen vessel on which the image of the sun has been drawn (with sandal or red sandars) in the form of interlaced triangles, the apices of which will represent his rays and a circle around them his form, and before presenting to it the water of the *argha* with flowers recite mentally the *dhyanu-mantra*|| and in

* The hands are clasped in front of the breast whilst this mantra is repeated :
Om namaḥ sambhaváya cha mayodbhaváya cha namaḥ śankaráya cha namaḥ śrúdyá cha śivataráya cha etc.

† The *váchana* consists of numerous verses in praise of the gods.

‡ The *sandhyá*, already noticed.

§ A small cup usually made of brass.

|| *Arūṣo rūṣapankuje niṣaṇṇaḥ kamale, bhātiraru karair dadhnaḥ svaruchāhita-maṇḍalas trinetra ravir ākalpaśatākulo vatānnaḥ.*

offering the water of the *argha*, the *mantra** in which the sun is invoked as the thousand-rayed, full of brightness, lord of the world, &c., and is asked to accept the domestic *argha* of his worshipper. Next sprinkle mustard-seed, sesamum and rice in order that no evil spirit may approach and interrupt the ceremony and use the *mantra*† for keeping off demons goblins. Then crack the thumb and second finger together three times and behind the back in order that the goblins behind may be driven away. The earth should next be saluted and afterwards Vishṇu with the verse :—‘O thou whose throne is the lotus, &c.’ Fill the *argha* once more and sprinkle all the materials for worship and go through the *prāṇáyāma*. Next take sesamum, *kuśu*-grass, barley and water, and make the great dedication‡ with the *mantra* :—‘Om Vishṇu, Viṣṇu, Viṣṇu, adoration to the supreme, the first eternal male,’ &c., with the usual definition of place, time and person, viz., in the island Jambu, the division Bharata, the country of the Aryas, in this holy place, the Himavat and hills, in the latter half of the life of Brahmá, in the holy *Várāha-kalpa*, at the end of the Krita, Tretá and Dwápara *Yugas*, &c., giving the year, season, month, fortnight, day and hour of the ceremony, with the name of the person in whose behalf the ceremony is performed, his father and grandfather’s name, caste and family, and the ceremony itself, with the prayer that the benefits to be derived from its performance may be bestowed on him.

Name of Gaṇeśa.—The worship of Gaṇeśa now proceeds, each step in the ceremony being accompanied by an appropriate *mantra*. First the *píttha* or triangle is addressed with the *mantra* containing the names of

* *Ehi sūryya sahasráṁśo tejorāśe jagatpate, anukampaya mām bhaktyá grihāṇārgham divákara.*

† *Apakrámantu bhūtánizśácháḥ sarvato dáśam sarveshám avirodhena brahmanakarmasamārabhet pákhaṇḍakáruṇo bhútá bhúmanu ve chántarikshagáh diviloke sthítá ye cha te naśyantu śivájñayá nirgachchhalám cha bhútánám vartma dadyát svavámataḥ.* The following is used in Bengal (Prof. Williams) for the same purpose :—“ Help me, goddess of speech : *Am* to the forehead, *Am* to the mouth, *Im* to the right eye, *Im* to the left eye, *Um* to the right ear, *Um* to the left ear, *Im* to the right cheek, *Im* to the left cheek, *Em* to the upper lip, *Aim* to the lower lip, *Om* to the upper teeth, *Aum* to the lower teeth, *Tam*, *Tham*, *Dam*, *Dham*, and *Nam* to the several parts of the left leg, *Pam* to the right side, *Pham* to the left side, *Bum* to the back, *Mam* to the stomach, *Yam* to the heart, *Ram* to the right shoulders, *Lam* to the neck bone, *Vdm* to the left shoulders, *Lam* from the heart to the right leg, *Ham* from the heart to the left leg *Agham* from the heart to the mouth.”

‡ *Om viṣṇuḥ viṣṇuḥ viṣṇuḥ namaḥ paramátmāne śrīpurdhnapurushottamáyá Om tatsadataprithivyaṁ jagnbúdwípe bharatakhaṇḍe áryyádvarte puṇyakshetre himavátparvataikadeśe brahmaṇodvityapurárdhe śrīsvetaváráhkalpe kṛitáretádúvaparānte saptame paicavátaṁvāntare aśṭávimśatítame kuliyugasya prathamacharaṇe shashṭyaváddānamadhye, &c.*

Gaṇeśa and of his mother:—*Oṃ* thou who art fierce (*tīvrá*), blazing (*jvālini*), Nandinī, the giver of pleasure (*bhogadā*), Kāmarūpā, Satyā, the terrible (*ugrá*), the bright (*tejavatī*), thou who removest all obstacles (*viḡhananāśinī*). *Oṃ* thou who sittest on the lotus, I meditate on thee, the one-toothed, elephant-headed, large-eared, four-armed, holder of the noose and goad, perfect Vināyaka."

Āvāhana.—This is followed by the invitation (*āvāhana*) to Gaṇeśa to be present and take the place prepared for him with the mantra:—*Vināyaka namas te'stu umāmalasamulbhava imāṃ mayā kṛitāṃ pūjāṃ gṛihāṇa sura-saṭtama*.—'Glory to thee Vināyaka, born of Umā, accept my worship, best of gods.'

Āsana.—Next comes the *āsana* or throne to which the deity is invited with the mantra:—*Nānāratna-samāyuktaṃ muktāhāra-vibhūṣitaṃ sparśasinhāsanaṃ chāra pratyartham pratiḡgrihyatāṃ*. 'Accept this golden throne, set with various gems and adorned with strings of pearls all for love of thee.'

Pādyā.—Next water for washing the feet (*pādya*) is offered with the mantra:—*Gaurīpriya namas te'stu śankarapriya sarvāśā bhaktyā pādyaṃ mayā dattaṃ gṛihāṇa praṇatapriya*.—'Glory to thee beloved of Gaurī, ever beloved of Sankara, accept the water devoutly presented by me.'

Argha.—Next the *argha* with the mantra:—*Vratam nūlīṣya deveśa gandhapushpākṣhatāir yutaṃ gṛihāṇārghyaṃ mayā dattaṃ sarvasiddhipradodbhava*.—'O lord of gods, who art the bestower of all blessings, accept this arggha furnished with sandal, flowers and rice, and given by me.'

Snāna.—Then the ablution (*snāna*) with the mantra:—*Snānaṃ pañchāmṛitair deva gṛihāṇa gaṇanāyaka anāthanātha sarvavajña gīrvāṇa paripūjita, oṃ gaṇātāṃ tvā gaṇapati gvaṃ havāmahe priyāṇāṃ tvā priyapati gvaṃ havāmahe nūlīṇāṃ tvā nūlhipati gvaṃ havāmahe vaso mama āham ajāni garbbhadhan ā tvam ajāni garbbhathan*.—'O god, leader of the heavenly troops, protector of the defenceless, omniscient, thou that dearest in invocations, accept this ablution made with the five kinds of ambrosia.* *Oṃ* thou who art leader of the attendants of S'iva, thou who art lord of the beloved, lord of the treasures (of Kuvera), thou who art my treasure, I who am without wife and relations invoke thee the procreator.'

Vastra.—Next sprinkle a little water with a spoon (*āchamani*) on the image of Gaṇeśa and proceed to clothe it (*vāstra*) with the mantra:—*Raktavastra-yugaṃ deva devāngasadrīṣaprabham, bhaktyā dattaṃ gṛihāṇedaṃ lambodara harapriya*.—'O God Lambodara, beloved of S'iva, accept this pair of scarlet garments, devoutly given.'

Janeo.—Then the *janeo* (*yajñopavīta*) or sacrificial thread is placed on the image with the mantra—*Rājataṃ brahmasūtraṃ cha kanchanasasyotta-*

* Milk, curds, butter, honey and sugar.

śrīyakṣaṃ, grīhāṇa chāru sarvavajña bhaktānāṃ siddhidāyaka.—‘O giver of happiness to thy worshippers, do thou who art omniscient, accept this pleasing sacrificial thread woven with gold and silver.

Gandha.—Next sandal (*gandha*) with the mantra:—*Gandham karpūra-samyuktam divyam chāmlanam uttaman, vilepanam suraśreshṭha prītyartham pratigrihyatām.*—‘O best of gods, let this agreeable sandal mixed with camphor be accepted as an unguent for thy person, for the love I bear thee.’

Akshata.—Next rice (*akshatāḥ*) with the mantra:—*Akshatāṃ dha-valān devasuraganḍharvopajita sarvadevanamaskāryya grīhāṇa mud-anugrahāt.*—‘Thou who art worshipped by the gods, Gandharvas and all the deities, accept my offering of white rice.’

Pushpa.—Next flowers (*pushpāni*) with the mantra:—*Sugandhāni supushpāni mūlatyāśīni vai prabho mayānītāni pūjārtham pushpāni pratigrihyatām.*—‘O Lord, accept the sweet-smelling garlands and flowers brought by me for thy worship.’

Dhūpa.—Then incense (*dhūpa*) with the mantra:—*Daśāṅgam guḍgu-lam dhūpam sugandhim sumanoharam, Umāśrīta namas tubhyaṃ dhūpam me pratigrihyatām.*—‘Hail to thee, O son of Umā, accept from me this incense consisting of bdellium and ten (other) ingredients, fragrant and very pleasing.’

Dīpa.—Then a lamp (*dīpa*) with the mantra:—*Grihāṇa mangalam dīpam ghṛitavarṇāḥ śīsamānvitam, dīpam jñānapradam devanudrapriya namo's-tu te.*—‘Accept this lamp, supplied with clarified butter, the bestower of knowledge, established in thy honour, O beloved of the gods.’

Naivedya.—Then sweetmeats (*naivedya*) with the mantra:—*Sagudān saghṛitām ś-chaiva molakān ghṛitapāchitān naivedyam saphalam dattam grihyatām vighnāśānu.*—‘O thou who removest difficulties accept these sweetmeats cooked in clarified butter.’ One of the sweetmeats should then be taken up and placed before the image of Gaṇeśa, who should also receive some article of value. Then repeat the *mūla*-mantra, which consists of a mental recitation (*japa*) of the formula *Om Gaṇeśāya namaḥ*—‘Om, glory to Gaṇeśa.’

Pān.—Next *pān* (*tāmbūla*) is presented with the mantra:—*Pūgi-phalasamāyuktam nāgarallūlānvitam, karpūralisamāyuktam tāmbūlam pratigrihyatām.*—‘May this *pān* with betel and the leaves of the betel and spices be accepted.’ When presenting the sweetmeats which are usually ten in number (hence the name *daśamolaka*) the following formula is used:—‘I (so and so) for this (so and so) purpose bestow on this Brāhman for the sake of Gaṇeśa these sweetmeats, rice, flowers and goods with this mantra:—*Vighneśa viprarūpeṇa grīhāṇa daśamodakān dakṣiṇāghṛitātāmbūlagudayuktān mameshṭada.*—‘O Vighneśa (obstacle-lord), in Brāhman form, accept these ten sweetmeats with the gifts,

clarified butter and *pán*, and grant my desire.' In reply the celebrant accepts the gift on the part of Gaṇeśa and says :—*Dātā vighneśvaro devo grihīta sarvvavighnarāḍṭasmāt idaṃ mayā dattaṃ paripūrṇaṃ tad astu me.*

Prārthana.—Next follows the prayer (*prārthana*) :—*Vináyaka namas tubhyaṃ satataṃ modakapriya avighnaṃ kuru me deva sarvakáryyeshu sarvadā.*—'Glory to thee Vináyaka, fond of sweetmeats, always protect me from difficulties everywhere.'

Dúrva.—This is followed by an offering of a stalk of *dúb* grass with the *mántra* :—*Oṃ gaṇádhipa namas te'stu oṃ umáputra namas te'stu oṃ aghandána namas te'stu oṃ vináyaka namas te'stu oṃ ísaputrā namas te'stu oṃ sarvasiddhipradáyaka namas te'stu oṃ ekadanta namas te'stu oṃ íbhavaktra namas te'stu oṃ enúshakaváhana namas te'stu oṃ kumáraguro tubhyaṃ namo'stu oṃ chaturthísa namo'stu te oṃ kándát kándát prarohanti paruśaḥ paruśas pari evá no dúrve pratana sahasreṇa śatena cha.* 'Oṃ, glory to the lord of the heavenly hosts, the son of Uma, the remover of obstacles, Vináyaka, the son of Íśa, the bestower of happiness, the one-toothed, with an elephant's head, having a rat as his vehicle, the preceptor of Skanda, the lord of the fourth day, to thee rise our hymns from these stalks of *dúb* budding at every knot with hundreds and thousands of shoots.'

Nirájana.—Next follows the *nirájana* or waving of a lamp before the image, which is accompanied by the following *mantra* :—*Antastejo bahisteja ekíkṛityámitaprabham áráttrikam idaṃ deva grihāna mad-anu-grahát, Oṃ agnir jyotirjyotir agniḥ sváhá sūryyo jyotir jyotiḥ sūryyaḥ sváhá agnir varchcho jyotir varchchaḥ sváhá sūryyo varchcho jyotir varchchaḥ sváhá sūryyo jyotir jyotiḥ sváhá.*—'O god accept from favour to me this ceremony of waving the light (*áráttrika*) before thee who art light, hail to Agni who is light, to the Sun who is light.'

Pushpánjali.—Then follows the offering of flowers in the hollow of both hands (*pushpánjali*) with the *mantra* :—*Sumukhaś chaikadantaś cha kapilo gajakarṇakaḥ lambodaraś cha vikaṭo vighnanáśo vináyakaḥ dhúmra-keṭur gaṇádhyakṣo bhálachandro gajánanaḥ.* This verse gives twelve names* of Gaṇeśa, and it is promised that whoever reads them or even hears them read when commencing to study or in making the preparations for a wedding, in coming in or going out, in war or in trouble will never meet with any obstacle that he cannot overcome. As the axe is to the jungle-creeper so this verse containing the names of Gaṇeśa is to all obstacles and difficulties.

* The usual names are Sumukha (beautifull-faced), Ekadanta (one-toothed), Kapila (red and yellow complexion), Gajakarṇaka (elephant-eared) Lambodara (corpulent), Vaikṛita (misshapen), Vighnanáśa (deliverer from difficulties), Vináyaka (leader), Dhuma-keṭu (smoke-bannered), Bhálachandra (better moon), Gajánana (elephant-visaged),

Dakṣiṇā-saṅkalpā.—Next comes the gift of money as an honorarium to the celebrant with the formula as in the first *saṅkalpā* and the usual definition of place, time, name, caste, &c., of the person who causes the ceremony to be performed and that it is for the sake of Gaṇeśa. The celebrant in return on the part of Gaṇeśa, asperses his client and places flowers, rice, &c., on his head, concluding with the mantra :—*Oṃ gaṇānāṃ tvā gaṇapati gvaṃ havāmahe priyānāṃ tvā priyapati gvaṃ havāmahe*, &c., as before. The Kṣātriyas very considerably abridges these observances but he knows Gaṇeśa (the Gaṇapati of the Dakṣiṇ) and reverences him and Gaṇeśa is clearly a non-Brāhmanical deity and is honoured as a follower of Śiva by the Pāśupatas from a very early period.

Mātrī-pūjā.—The ritual for the *Mātrī-pūjā* comes into use after the service for Gaṇeśa and usually forms a part of the preface to any other ceremony. The celebrant takes a plank and cleans it with rice-flour and then draws sixteen figures representing the *Mātris* and to the right of them a figure of Gaṇeśa. Then in the upper right-hand corner the sun is represented as in the *Gaṇeśa-pūjā* and in the upper left-hand corner the moon by a number of lines intersecting a central point and having their extremities connected by a series of semi-circles. The celebrant then makes a brush from five or six stalks of *dūb*-grass and

Gaṇādiśa (lord of the celestial hosts). The following is a rough translation of the address :—

1. Whosoever shall worship thee under these twelve names and even whosoever shall attend and hear them read shall certainly prosper in this world.
2. Whosoever shall repeat these twelve names on the day of marriage or on the birth of a child, or on proceeding on a journey or on going to battle or in sickness or on entering a new house or business shall be freed from the effects of evil.
3. O Vakratuṇḍa, O Mahākāya, resplendent like a thousand suns, prosper my work always, everywhere.
4. O thou of the great body and short in stature, whose head is like that of an elephant. Thy breath like nectar attracts the insects hovering in the ether to thy lips. Thou art able with one blow of thy tusk to destroy the enemies of thy suppliants. Thou that art the adopted son of Devī hast vermilion on thy brow and art over liberal. Thou art such, O Gaṇeśa, that I bow to thee, the beautiful one of a yellow complexion and three-
5. Presenting this lamp I wave it before thee. Thou, O Lambodara, who art the ruler of the universe, the adopted son of Pārvatī, aid me.
6. All men worship thee and adore thy feet; thou that livest on sweets, and art borne on a rat and whose abode is magnificent, aid me.
7. Thou that bestowest wealth and accomplisheth the desires of thy worshippers, aid me.
8. Thou who wieldest the trident and hast ever been merciful to me. Most assuredly all who worship thee shall obtain every happiness.

dipping it in cow-dung touches each of the figures which represent the *Mātrīs*. Then the *argha-sthāpana*, *prāṇāyāma* and *sankalpa* as in the preceding ceremony are gone through with the formula as to place, time, caste of celebrant and object, &c., of the ceremony which is addressed to Gaṇeśha and Gaurī and the other *Mātrīs*.

Pratishṭhā.—Then the *Mātrīs* are praised in certain verses* known as the *pratishṭhā*, then again in the *dhyāna* or meditation, and again by name whilst presenting a flower to each:—“*Oṃ gaṇapatiḥ namah*,” followed by Gaurī, Padmā, Sachī, Medhā, Devaṣeṇā, Svadhā, Svāhā, Mātri, Lokmātri, Dhriti, Pushti, Tushti, and the household female deities. The formulæ connected with the invitation, &c., in the preceding ceremony are then gone through, viz.:—*arāhaṇa*, *āsana*, *pādya*, *argha*, *śāṇa*, *āchamana*, *vastra*, *gandha*, *akshata*, *pushpa*, *dhūpa*, *dīpa*, *nivedya* and gifts.

Vasordhārā.—Next comes the *vasordhārā*, which is performed by taking a mixture of clarified butter and a little sugar and having warmed it in the *argha*, letting it stream down the board some three, five or seven times whilst repeating a mantra. The celebrant then receives a piece of money from the person for whose benefit the ceremony is performed, and dipping it in the clarified butter (*ghṛi*) impresses a mark on the forehead and throat of the person from whom he receives it and keeps the coin. Then comes the *nirājana* or waving of a lamp before the figures as in the preceding ceremony. Next follows the offering of flowers in the upturned palms of the hands (*pushpāñjali*), winding up with a hymn in honour of the sixteen *Mātrīs* and gifts to the celebrant, who in return places flowers from the offerings on the head of the giver. The worship of the *Mātrīs* or divine mothers is another very interesting observance of other than Brāhmanical origin. They are revered as separate entities in the *Mātri-pūjā*, *Dvāda-mātri-pūjā* and *Jīva-mātri-pūjā* and here have no apparent connection with the worship of the female energy or consort of the great divinities. They are found under various names amongst the beings worshipped by the aboriginal and non-Aryan tribes throughout the whole of India and in the Bauddha system of Nepāl and Tibet, and have come from that demonism which has had such influence on both Buddhism and S'aivism and which found its development in the Tantras of both sects. Enough has not yet been recorded to satisfactorily assign to them their exact place in the cycle of evolution, but there is no doubt that the conceptions known as divine mothers have held a high position and an important influence on the

* Rice is here taken and sprinkled over each figure whilst the *pratishṭhā* is spoken and during the *dhyāna* the hands are clasped reverently in front of the breast and the head lowered and eyes closed.

changes in religion which occurred between the eighth and twelfth centuries of our era.

Nāndī-śrāddha.—The *Nāndri* or *Nāndī-śrāddha* is also called the *Abhyudika-śrāddha*, and though not universally observed here is sometimes introduced into the preparatory ceremonies. It opens with an invocation of Gaṇeśa. The celebrant then draws a figure of a conch and discus on the ground and makes an *āsana* or throne of three stalks of *dūb*-grass, on which he places a *pātra* or small brass-vessel like a *lota* and on it the *pavitra*.* Water, barley and sesamum are then applied, with appropriate mantras, and in silence, sandal, rice and flowers. The materials for the ceremony are then sprinkled with holy water whilst repeating a prayer. Next comes the *prāṇāyāma*, a prayer for the presence of the deities in the house, a story of the adventures of seven hunters on the Kālānjar hill and the *saukalpa* or dedication. Then the enumeration of the ancestors for three generations on both the paternal and maternal side† and their adoration. This is accompanied by the invitation, &c., as in the preceding ceremonies for each of the twelve ancestors named and by special mantras which are too tedious for enumeration here.

Kalaśa-sthāpana.—The *kalaśa-sthāpana* or consecration of the water-pot is usually observed and commences with the washing of the *kalaśa* or vessel with sandal, curds and rice and covering it with a cloth. Beneath it is placed a mixture of seven sorts of grain, and then the person who causes the ceremony to be undertaken places his right hand on the ground whilst the celebrant repeats the mantra :—‘*Oṃ mahī dyauprīthivi cha na imam yajñam mimikṣatām pipritām no bharīmabhiḥ*.’ Then barley is thrown into the vessel and a hymn is chanted whilst water is poured over the vessel. Then the *kuśa-brahma*‡ is placed on it and sandal,

* The *pavitra* is made from a single stalk of *kuśa* grass tied in a knot of the form of a figure of eight. Each stalk has three leaves which some suppose are emblematic of the deity.

† In the male line an addition is made to the name to show the degree: thus the father has the addition *vasu svarūpa*, the grandfather that of *rudra svarūpa*, and the great-grandfather that of *āditya svarūpa*. Another addition is made to show the caste: thus a Brāhman is called *śarmma*, a Kshatriya is called *varmma*, and a Vaiśya or Sudra is called *gupta*. Amongst Brāhmans the real names of females are not given: the first wife of a Brāhman is called *sundarī* and the second and others *mundarī*. In other castes the real names are given as in the case of males. Thus Rāmapati Brāhman's father, known in life as *Krishṇadatta*, would, at a ceremony undertaken by Rāmapati, be called *Krishṇadatta śarmma vasu svarūpa*, and Rāmapati's mother, if the first wife of his father, would be called *Krishṇadatta sundarī vasu svarūpa*.

‡ This consists of fifty stalks of the grass tied together and separated at one end into four parts by pieces of the grass placed at right angles to each other and to the bundle itself. The projecting edges of these pieces prevent the bundle falling completely into the pot or vessel.

dúrva, turmeric, milk, curds, clarified butter, the five leaves (*pippala*, *khadira*, *apámarga*, *udumbara* and *paláśa*), the earth from seven places (where cows, elephants, white-ants live), the five gems,* coins and articles of dress with appropriate mantras. Then Varuṇa is invoked and the water, &c., in the *kalāśa* is stirred whilst these verses are recited in honour of the vessel:—‘Vishṇu dwells in thy mouth, Rudra in thy neck and in thy bottom Brahma: in thy midst dwell the company of the Mātṛis: within thee are the seven oceans, seven islands, the four Vedas and the Vedāngas. Thou wert produced at the churning of the ocean and received by Vishṇu, thy waters contain all places of pilgrimage, all the gods dwell in thee, all created things stand through thee and come to thee. Thou art S’iva, Vishṇu and Prajāpati, the sun, Vasu, Rudra; all the deities and all the Maruts exist through thee. Thou makest works fructuous and through thy favour I perform this ceremony. Accept my oblations, be favourable to my undertaking and remain now and ever with me.’ Then the vessel is worshipped with praise and prayer to the same intent. Next the *argha-sthāpana*, *prāṇāyāma* and dedication as in the previous ceremonies take place, and again the *kalāśa* is declared to be the abode of all the gods to whom the invitation, &c., as in the previous ceremony are given, viz.:—to Brahma, Varuṇa, Aditya, Soma, Bhauma, Buddha, Vṛihaspati, S’ukra, S’anaishcara, Rāhu, Ketu, Adhidevatās, Pratyadhidevatās, Indra, the ten Dikpālas and the five Lokapālas. Then follows the waving of a lamp, offering of flowers and gifts with a dedication as before.

Rakshāvidhāna.—The ceremony of *rakshāvidhāna*, commonly known as *rakshābandī*, is seldom carried out in its entirety except by the wealthy. It consists in binding as an amulet a bracelet of thread on the right wrist, and the rite commences with making a mixture of barley, *kusa*-grass, *dūb*-grass, mustard, sandal or red sandars, rice, cow-dung and curds, which is offered on a brazen platter to the bracelet forming its *pratishṭhā*. Then the person about to put on the bracelet invokes the presence of various deities to protect him from evil and says:—“To the east let Govinda protect me; to the south-east, Garuḍahvaj; to the south, Vārāha; to the south-west Nāra Siṃha; to the west Keśava; to the north-west Madhusūdana; to the north S’ridhara, and to the north-east Gadādhara, above let Govardhana protect me; below, Dharapidhara and in the ten quarters of the world Vasudeva who is known as Janārdana. Let the conch protect me in front and the lotus behind; on the left, the club and on the right, the discus. Let Upendra protect my Brāhman and Vishṇu in his dwarf incarnation protect my Āchārya; let Achyūta protect the

* Gold, diamond, sapphire, ruby and pearl; but it may easily be supposed that these are seldom given.

Rigveda; Adhokshaja, the Yajurveda; Kṛṣṇa, the Sāmaveda; Mādhava, the Atharvaveda and Aniruddha the other Bráhmans. May Puṇḍarika protect the performer of the sacrifice and his wife and let Hari protect all defenceless places." The rubric goes on to say that the defence of the unprotected can always be effected by using *mantras* from the Vedas and the seeds of white mustard. In Kumaon a few coins are with turmeric, betel and white mustard seed tied up in a small bag (*poṭalí*) of white cloth and attached to the *rakshá* or bracelet until the work in hand, whether marriage or other ceremony, be accomplished. When this takes place the bag is opened and the contents are given to the officiating priest. The *mantra* commonly used in tying on the *rakshá* is as follows:—"Yena baddho balirájá dānavendro mahábalah, tena twám abhibadhnámi rakshemá chalamáchala," &c.

Játakarman.—The ceremony known as *játakarman* takes place on the birth of a son and is the next more important of those observed in Kumaon. It is divided into several sections which are considerably abbreviated in practice. The rite should be performed either on the day of the boy's birth or on the sixth day afterwards. If the father be at home, he should rise early and bathe and make the dedication as already described for the boy's long life, health and wisdom. He should then worship Gaṇeśa and make this his object that the boy should always be good, strong and wise, and that if the mother has become impure by violating any of the laws as to conduct or what should not be eaten, that her sin should be forgiven her and its consequences should not be visited on her boy. With the same object he performs the *Mātri-pújá* and the *Nándi-sráddha* already described. Sometimes the *puṇyáha-váchana* follows, which is merely the citation, feeding and rewarding some Bráhmans to be witnesses that the rite has been actually performed. The *kalaśa-sthápana*, already described, follows and after it the *navagraha* or nine planets are invoked to be present and assist. A vessel of some bright material is brought, and in it is placed a mixture of clarified butter and honey, with which the tongue of the child is anointed either with a golden skewer or the third finger of the right hand, whilst a prayer is read asking for all material blessings for the boy. The father then presents a coin to the celebrant, who dips it in a mixture of clarified butter and charcoal and applies it to the forehead and throat of both father and son and then with a prayer places flowers on their heads. The father then takes the boy in his lap and touches his breast, head, shoulders and back, whilst appropriate *mantras* praying for strength for those parts of the body are read by the celebrant. A present is again given to the celebrant and after it the umbilical cord is cut, leaving four finger-breadths untouched. The *abhisheka* or purification is then performed by

aspersing the assemblage with a brush formed from *dūb*-grass and dipped in the water of the *argha*. The frontal mark is then given with red sandars and a flower is presented with a verse committing the donce to the protection of the great god.

Shashthī-mahotsava.—The *shashthī-mahotsava* or great rejoicing in honour of Shashthī is held on the sixth day after the child's birth. If the father cannot afford to engage the services of a priest he can perform the ceremony himself, but usually he sends for his *purohita* and commits its duties to him. The father rises early and bathes, performing the *nitya-karma* as usual. He fasts all day and towards evening makes a ball of clay and smears it with cow-dung. He then takes a plank of wood and having cleaned it with rice-flour draws on it images of Skanda, Pradyumna and Shashthī. He then surrounds each figure with a hedge of cow-dung about a finger-breadth high and sticks upright in this hedge grains of barley. The image of Shashthī is then smeared with cow-dung in which cowries or coins are placed, and next follows the *Dwāra-mātrī-pūjā*: The father of the boy collects the materials for worship near the door of the house, and there drawing the figures of the mothers with rice, consecrates an *argha* and dedicates the rite to the day's ceremony. The goddesses are then installed:—‘*Oṃ bhūr bhuvah swah Dwāra-mātaraḥ* be established here and grant our reasonable desires.’ Then a short meditation takes place, followed by an ‘*Oṃ, hail*’ to Kumā, Dhanadā, Nandā, Vipulā, Mangalā, Achalā and Padmā, and the usual invitation, &c., as far as the dedication. Next comes the *Gaṇeśa-pūjā* with rinsing of the mouth and a dedication, then the *Mātrī-pūjā* with similar detail, the *pūjyāha-vāchana* and *kalaśa-sthāpana* with an invitation to the nine planets to be present. The worship of Skanda and Pradyumna then proceeds with the usual installation address (*pratishthā*), meditation, invitation, &c., and prayer (*prarthana*) during the offering of flowers. This is followed by the *Shaṭkṛitīkā-pūjā* or worship of the six nymphs, the foster-mothers of Skanda when amongst the *Kṛitīkās*, with an enumeration of his names and an invocation to Sīvā, Sambhūti, Sannati, Prīti, Anusūyā and Kshamā. Next comes the worship of Shashthī with the usual consecration of the *argha*, *prāṇāyāma*, dedication and installation.

The *pratishthā* in honour of Shashthī is as follows:—“*Oṃ bhūr bhuvah swah* (*vyāhṛti-mantra*), O Shashthī-devī, come here to this magical place which is smeared with cow-dung, remain here, consent to be honoured here. Then follows the unintelligible mystical formula *ॐ अं ह्रीं क्रौं यं रं लं वं षं षं हं चं चंसः होहं* followed by “May Shashthī-Devī in spirit and essence be here and may the regents of all the senses be present.” The mental assignment of the different parts of the body to its own peculiar tutelary deity (*nyāsa*) follows and should be made with the following for-

mula :—*Oṃ khá*, glory to the heart ; *Oṃ khí* to the head, *sváhá*, (here meaning 'Hail') ; *Oṃ khú*, to the top-knot, *vashaṭ* (here meaning 'Hail') ; *Oṃ khai*, to the mystical armour of the mantra, *hún* ; *Oṃ kharu*, to the eyes, *vaushaṭ* (like *vashaṭ*) ; *Oṃ khá*, to the mystical weapon of the mantra, *phat*. The *Shashthí-nyása* differs little from the *Anga-nyása* formula already described. Then follows the meditation on *Shashthí* as *Mahá-devi*, of the large breasts, four-armed, the consort of *Siva*, swollen out like a peacock, clad in yellow clothes, beautiful, bearing a lance in her hand, *Maheśvarí*, &c. After the worship of *Shashthí* has been finished a garland of sweetmeats is thrown around the neck of a male kid. The ears of the kid are pulled until it bleats loudly some five or six times in order to frighten and drive away the evil spirits who are supposed to seek to disturb the ceremony. *Shashthí* is again addressed to protect the boy from evils by flood or field, by hill or dale, from wild animals by night or day ; whilst the father takes the child in his lap and again touching the several parts of the body listens to the appropriate prayers for strength, wealth and long life. The ceremony ends with a story illustrating its origin. The above fairly represents the character of the mantras used in the ceremonies, and that these are of *Tántrika* origin and common alike to Buddhism and the Hinduism of the present day may be distinctly shown. Cunningham in his *Ladák* (p. 384) gives several mantras collected by him from Tibetan-Buddhist sources which in form and character are the same as those in use in the Kumaón *Himálāya*. Compare his mantra of *Sákya Thubba* (Buddha) :—*Namaḥ Sámanta buddhínám sarvaklesha níśuddhana sarvva-dharma vakiprapta gayana sama sama sváhá*—'glory to the chief of Buddhas, reliever of all suffering, master of all virtue, equal, equal to the heavens, hail.' Again we have :—*Namaḥ sámanta vajránám chaṇḍa mahároshana hún*—'glory to the chief of Vajras, fierce and greatly hungry, hail' ; and :—*Oṃ vajra—krodha, háyagríva hulu hulu hún phat*. This last 'is addressed to the supreme Buddha (*Bhageśwara*), to the celestial *Bodhi-sattwa*, *Padmapáni* and *Vajrapáni* (the lotus and sceptre-bearers) and to the *Tántrika* divinity *Íśwara*.' The same ideas permeate the mystical formulæ used by Musalmáns of the lower classes, descendants of Hindú converts, only the names of *Jibráíl*, *Azráíl*, &c., are generally used instead of the names of the Indian and Tibetan spell-compelling deities. In a curious figure given by Herklots we have names derived from all three systems and common to the Tantras of all. It represents the double *Nága* emblem of the male and female principle, and is used by exorcisers in avoiding the influence of evil spirits. It is shown in Plate I, fig. 2, as giving a fair example of a magic figure and showing how wide practices here referred to are.

Another is addressed to Hanumán, Narasiṃha, Baitála and Bhairava : another is adorned with the *triśúla*, the distinctive emblem of the montane S'aivas, and all are of the same character as the *yantras* used by Hindús.

Namakarāṇa.—The *námakarāṇa* or naming the child takes place on the tenth to the twelfth day after birth. In Kumaon, it is held almost universally on the eleventh day and the ritual opens with a series of somewhat abstruse general rules for selecting names. The Gaṇeśa-*pújá* is as usual first performed, stating the particular object for which it is undertaken. Then follows the *Nándi-srāddha* and an oblation to the fire made with clarified butter. Then a mixture called the *pañcha-gavya* is formed of the following ingredients :—the urine of a slate-coloured cow, the dung of a black cow, the milk of a copper-coloured cow, the curds of a white cow and the clarified butter of a pie-bald cow. This mixture is made up into small balls and a portion used as a burnt-offering (*homa*), and the remainder is strewn about the house and byres and also thrown on the mother of the boy to purify her. A *homa* is then made of coins which are thrown into the fire and afterwards become the property of the celebrant. The child's name is next settled and written on a small piece of clean cloth and also whispered in his ear :—"Thy name is so and so, may thou have long life, health and prosperity." Gifts are then made to the celebrant and all retire to the courtyard, where a figure of the sun, such as already described, is drawn on the ground and revered with the usual ceremony. The boy is allowed to see the sun this day and is made to plant his foot on a piece of money placed on the ground (*bhūmi upaveśana*) whilst calling on the names of the deities that hereafter he may be able to esteem money as the dirt under his feet. The party then return to the house, where the *Jiva-mātri-pújá* is performed. It consists in the rinsing of the mouth followed by the consecration of the *argha* and a dedication as in the *mātri-pújá*, but the figures are only seven in number and are drawn on the wall of the house, not on wood, and the deities honoured are Kalyáni, Maṅgalá, Bhadrá, Punyá, Punyamukhá, Jayá and Vijayá. These are worshipped with the usual ceremonies including the invitation, &c., and the *vasordhárá* already described and then gifts are made to Bráhmans.

Janmotsava.—The *janmotsava* takes place on the anniversary of the birth of a male and the ceremony connected with it may be performed either by the person whose birth-day is celebrated or by the family *purohita* on his behalf. In either case the person for whose benefit the rite is performed must rise early in the morning and have his body anointed with a mixture of sesamum, black mustard and water and then bathe in warm water and put on clean clothes. When bathing, a prayer is read which brings in the place and date, his name, caste and race, and

asks for long life and prosperity, and to be truly effective this prayer should be said when the past year of the native's life merges into the coming year. Then the names of the principal deities are repeated in the form of a short litany, and their aid and assistance during the ensuing year are invoked. Should the anniversary fall on a Tuesday or Saturday which are regarded as unlucky days, the ceremony cannot take place, but in its stead, the person who desires to derive benefit from the rite should bestow gifts on Bráhmans and in charity, and in this way he shall obtain all the advantages which the performance of the complete ceremony is supposed to ensure. It is only in this abbreviated form, moreover, that the majority of Hindús in Kumaon observe this rite.

Karṇavedha.—The *karṇavedha* or piercing the ear may, according to the family or tribal custom, take place at any time between the third and seventh year. The rite is said to have been established by Vyása, and the date for its performance is always fixed by the family astrologer. The father of the boy must rise early and perform the Gaṇeśa-pújá and state precisely the object by giving place, time, name, &c., and declaring that it is for the increase in length of life, strength, wisdom and good fortune of his son, whose name is also given. He then goes through the *Mátri-pújá*, *Nándi-sráddha*, &c., as in the preparatory ceremonies already described. The mother takes the child in her lap and gives him sweetmeats whilst the operation of piercing the ear is performed: first the right and then the left ear with appropriate mantras, winding up with the usual gifts to the astrologer and *purohita*. Then follows the *abhishheka* or aspersion and the presentation of flowers and the *mahánirájana*, in which the family barber appears with a brazen tray bearing five lamps made of dough, four at the corners of a square and one in the centre in which the wick floats in molten clarified butter. These are waved in the manner of a censer in front of the assembly, who each make an offering to the barber according to his ability.*

Worship of the planets.—The *Upanayana* or ceremony of putting on the *janeu* or sacrificial thread is always preceded by the worship of the planetary bodies. For this purpose a *yajñasála* or hall of sacrifice is prepared to the east or north of the house and purified with the *pancha-gavya*,† whilst prayers are read as each article of the mixture is used. As a rule, however, the ceremony is performed in the cow-shed, in the

* I omit the ceremony styled *Aksharasulkára vidyárambha*, which takes place when a boy first goes to school, as I have never heard of its having been used. It consists principally of an enumeration of all the books, teachers and schools of philosophy known to the compiler with laudatory verses and prayers that they should be present and assist in the ceremony and in the youth's studies.

† Already described.

northern corner of which a very simple miniature altar of three steps* known as the *grahavedī* is raised. On the top of the altar the figure of a lotus with eight petals is drawn and each petal is coloured to represent a planet, red for the sun; white for the moon; reddish-brown for Bhauma (Mars); whitish yellow for Budha (Mercury); yellow for Vṛihaspat or Guru (Jupiter); white for S'ukra (Venus); black for Śanīchara (Saturn) and for Rāhu (an eclipse) and brown for Ketu (a comet). For the other deities the intervals between the petals are used. Offerings of rice and curds are then made to each and the usual invitation, &c., are made. On the morning of the day after these preparations have been completed, the usual preparatory ceremonies already described are gone through, including the *Nitya-karma*, *Gaṇeśa-pūjā*, *Mātri-pūjā*, *Nāndī-śrāddha* and *Puṇyāha-vāchana*. Then the person who causes the ceremony to be performed gives the *tilaka* or frontal mark to the *purohita* also the *argha*, flowers, rice, sandal and presents of coin, ornaments and wearing apparel and requests him to preside at the ceremony.† The parents of the child with the celebrant and the assembled friends then march round the *yajña-śāla* to the sound of conches and other instruments and enter by the western door, when the ceremony of purifying the hall with the *pancha-gavya* is again performed. To the south-west of the *grahavedī* a small *homa-vedī* or altar for burnt sacrifice is built and a fire is lighted thereon.

The worship.—The celebrant then performs the *kalaśa-sthāpana* and appoints the *pradhānu-dīpa* or guardian of the lamp to stand in the east and prevent the lamps going out, lest the ceremony should be interrupted by sprites and goblins. The worship commences by the celebrant presenting to each leaf of the lotus on the *graha-vedī*, a piece of metal stamped with the conventional image of the particular planet to which the leaf is sacred. (Then the greatness of each planet is praised and litanies are read and each is invited to be present in the place assigned to it on the *graha-vedī*.) All face towards the sun and the figure of the sun towards the east. These are then addressed in the *agnyuttaraṇa* and then washed with the five *amṛita*, each ingredient as it is applied being accompanied by a separate mantra. Then cold water is offered and the dedication made with the hymn of praise to:—*Oṃkāra*,

* The lowest step is two finger-breadths high and broad, the next is of the same height but four finger-breadths broad, and the last is four finger-breadths higher than the second and one cubit square at the top.

† Arrangements are made in the ritual for the presence of the *Āchārya*, *Brāhmaṇ*, *Ritwika* or prompter and *Sadaśya*, but as a rule all these offices are performed by one person. The ritual for this ceremony extends over eighty pages of my manuscript and is said to occupy three days in recital: it need hardly be said that the full ritual is seldom or never gone through.

Brahmaṣhi, Gāyatrī, Chhandah and the supreme deities; the Vyāhṛiti-mantra, Viśvāmitra, Jamadagni, the metres known as the gāyatrī, uṣhṇi and anuṣṭubh and the deities Agni, Vāyu and Sūryya, who are asked to assist in the ceremony. Then the vyāhṛiti-mantra is recited separately and together thus :—*Oṃ bhūh* I invite and set up the sun; *Oṃ bhuvah* I invite, &c.; *Oṃ svah* I, &c.; *Oṃ bhūr bhuvah svah*, I, &c., and the figure of the sun is placed on a small circular altar erected in the middle of the *graha-vedi*, then the invitation is made with the mantra :—*Oṃ akṛishne*, &c. Next Agni is addressed as *adhideva* of the sun, and invited to be seated on his right hand with the vyāhṛiti-mantra separately and together as in the case of the sun and also a special mantra for the invitation :—*‘Oṃ Agnim dūtām,’* &c. Next on the left side Rudra is invited as the *pratyadhideva* in the same manner and the invitation mantra commences :—*‘Oṃ tryambakam,’* &c. Next in the south-east corner the figure of Soma is set up with a similar ceremony on a small square altar. Next comes Angāraka or Bhauma on a triangular altar, Budha on an arrow-shaped altar, four finger-breadths long, Guru or Vrihaspati on an altar six finger-breadths square, Śukra on a five-cornered altar, nine finger-breadths across, Śani on a bow-shaped altar two finger-breadths broad, Rāhu on a sword-shaped altar, and Ketu on one like a standard. Then the other deities are invited: first the protecting deities, Gaṇeśa, Durgā, Kṣhetrapāla, Vāyu, Akāśa, and Āśvinī. Then the guardians of the rite, Indra on the east, Agni on the south-east, Yama on the south, Nirṛiti on the south-west, Varuṇa on the west, Vāyu on the north-west, Kuvera on the north and Īśa on the north-east. Next Brahma is invited to take his place in the upper part of the central space on the *graha-vedi* and Ananta in the lower portion. Next in the north-eastern corner already sacred to Īśa, the *kaluśasthāpaṇa* is made and the figure of Varuṇa is placed on the cover over the mouth of the vessel. All this is supposed to be done with the same tedious ceremony.

The meditation.—The thread from which the bracelet is made (*raṅksha-sūtra*) is now tied round the neck of the vessel (*kaluśa*). Then rice is taken in the hand and sprinkled over all the figures whilst they are asked to come and take their place in the vessel and in the bracelet. Then follows the dedication of the rite to the ceremony about to be performed on behalf of the boy. Next the *dhyāna* or meditation is given :—“*Oṃ* who sittest in the position called *padmāsana* (i. e., with thighs crossed, one hand resting on the left thigh and the thumb of the other on the heart and the eyes looking towards the nose), with hand like a lotus, sprung from a lotus, who driveth the chariot yoked with seven steeds, two-armed, ever present *Ravi*. *Oṃ* thou who art white, clothed in white garments, driving white horses, adorned with white, bearing a club, two-armed, ready to do what is right, *S’āsī*. *Oṃ* thou with the reddish garland and clothes, bearing

a pike, lance, and club, four-armed, moving like a goat, granter of requests, *Dhará-suta*. *Om* thou clothed in yellow garments encircled with yellow garlands, sprung from the pericarp of the lotus, club-holder, two-armed, seated on a lion, granter of requests, *Budha*. *Om* Guru of the Devas and Daityas, clothed in white and yellow, four-armed, who grantest the wishes of ascetics, with rosary, thread and alms-dish. *Om* thou who shinest like a sapphire, holding a lance, granter of requests, vulture-borne, arrow-discharger, *Arka-guta*. *Om* thou who art clad in blue, whose body is blue, crested with a diadem, bright, seated on a blue lion, such O *Ráhu* is praised here. *Om* thou who art of a brown colour, two-armed, club-wielder, with distorted face, always mounted on a vulture, grantor of desire, *Ketu*." A second meditation of the same import is then prescribed and others for *Varuṇa*, &c. Then to all the deities named the *ásana*, &c., as far as the flower-offering, are given and *Vyása* is quoted in praise of the nine planets. When procurable, cocoanuts should now be offered with fruit, flowers, and goods as well as the food supposed to be agreeable to each deity: thus for the sun, balls of rice and molasses are provided: the moon receives a *bali* of rice, clarified butter and milk; *Bhauṃa*, one made of rice, molasses, clarified butter and milk (*atkarika*); *Budha*, one made of milk and rice; *Vṛihaspati*, simply clarified butter and rice; *S'ukra*, curds and rice; *S'ani* obtains a mixture of rice, clarified butter and vegetables; *Ráhu* has goat's flesh; *Ketu*, rice of various colours; whilst the remainder obtain milk and rice. 'If these different ingredients are not procurable an offering of milk and rice is made to all.

Consecration of the materials for sacrifice.—The celebrant then approaches the *homa-bedí* and looking towards the east makes the usual rinsing of the mouth, and then proceeds through the whole ceremony of consecrating the materials for the sacrifice from the appointment of the *Bráhmaṇ* (*brahmopaveśana*) to the general aspersion (*paryukshaṇa*), after which gifts are made to the celebrant. A kind of preface is then read giving the names of the several deities and the materials with which they should be worshipped. This is followed by the *agni-sthāpana* by which *Agni* is invited in the different forms in which he is present on the altar as each of the nine planets, receives worship, and the throne, &c., are presented to him. Lines which represent the tongues of flame on the altar are then drawn and adored, and the father of the boy receives fire from the celebrant and bending the right knee so as to allow the thigh to lie flat on the ground before the altar, meditates on *Prajápati*, and commences the burnt-sacrifices by the offer of the *ághāra-homa* with clarified butter. Fuel* (*samidh*) for the altar is supplied from the wood of the following

* The wood of these trees is supposed to be cut up into pieces measuring a span of the hand of the boy who is the subject of the rite. Three stalks of *dárud* or *kúta* make one *samidh*.

trees and plants:—*Arka* (*Calatropis gigantea*), *Palāśa* (*Butea frondosa*), *Khadira* (*Acacia catechu*), *Apāmārga* (*Achyranthes aspera*), *Pīpala* (*Ficus religiosa*) and *Uḍumbara* (*Ficus glomerata*), *S'ami* (*Acacia suma*), *Dūrvā* (*Cynodon dactylon*) and *kūśa* (*Eragrostis cynosuroides*). These pieces of wood and plants must not be crooked, broken, worm-eaten, &c., and must be steeped in curds, honey and clarified butter before they are offered to the nine planets as a *homa*. If the wood of the other trees mentioned is not procurable that of the *palāśa* or *khadira* may be used alone. There are three positions for the hand during the *homa*:—(1) the *mrigī* (doe), (2) the *hamsī* (female swan) and (3) *śūkari* (sow). In the *śūkari* the hand is closed and the fingers lie in the palm on the hand; the *mrigī* extends the little-finger whilst the remaining fingers continue within the palm of the hand, and the *hamsī* extends the fore-finger whilst the hand is closed. The *mrigī-mudrā* comes into use in all ceremonies undertaken in order to avoid threatened dangers or the retribution due to evil deeds: the *hamsī-mudrā* in the rites observed for increase in health, wealth or prosperity, and the *śūkari-mudrā* in spells for malevolent purposes, in incantations against an enemy and for causing any mental or bodily misfortune to him. If the *homa* takes place without its proper spell (*mudrā*), the offering is fruitless and misfortune shall assuredly occur to both the celebrant and his client.

The oblation.—The *homa* is then offered in the name of each deity with a short dedication and mantra whilst the name of the presiding Rishi supposed to be present is given as well as the form of Agni. As this ceremony is gone through forty-two times, the result may be tabulated as follows:—

The nine planets.

No.	Name of deity.	Material employed in the <i>homa</i> .	Initial words of mantra.	Presiding Rishi.	Form of Agni.
1	Sun ...	<i>Arka</i> ...	<i>Om Akrishṇe</i> , &c.	Hiranyastūpa.	Kapila.
2	Moon ...	<i>Palāśa</i> ...	<i>Om imam devā asapatna gvaṃ</i> , &c.	Gautama.	Pingala.
3	Bhauma ...	<i>Khadira</i> ...	<i>Om agnir mūrddhā</i> , &c.	Virūpāksha.	Dhūmraketu.
4	Budha ...	<i>Apāmārga</i> , ...	<i>Om udbuḍhyasvāgne</i> , &c.	Parameśthi.	Jāthara.
5	Vṛihaspati,	<i>Pippala</i> ...	<i>Om vṛihaspate</i> , &c.	Gṛtsamada.	Sikhi.
6	Śukra ...	<i>Udumbara</i> , ...	<i>Om annātparisrutora-saṃ</i> , &c.	Prajāpati, Aśvi, Sarasvatī and Indra.	Hātaka.
7	Sani ...	<i>Sami</i> ...	<i>Om sannodevī abhishṭayah</i> , &c.	Dadhyañśātharvaṇa.	Mahāteja.
8	Rāhu ...	<i>Dūrvā</i> ...	<i>Om kayā naś chitra</i> , &c.	Vāmadeva.	Hutāsana.
9	Ketu ...	<i>Kūśa</i> ...	<i>Om ketum</i> , &c.	Madhuchohhanda.	Rohita.

The Adhidevatás.

For these and the succeeding deities *paláśa* is the wood prescribed and no particular form of Agni is mentioned.

Number.	Name of deity.	Initial words of mantra.	Presiding Rishí.
10	Agni ...	<i>Om agnim hūtam, &c.</i> ...	Kaṇva and Medhātithi.
11	Apa ...	<i>Om āvanīdāra, &c.</i> ...	Vrihaspati.
12	Prithiví ...	<i>Om syonáprithivi, &c.</i> ...	Medhātithi.
13	Vishṇu ...	<i>Om idam viṣṇur vichakrama, &c.</i> ...	As in 10.
14	Indra ...	<i>Om sajośháḥ, &c.</i> ...	As in 4.
15	Indrápi ...	<i>Om adityá, &c.</i> ...	Ditto 7.
16	Prajápati ...	<i>Om prajāpate, &c.</i> ...	Hiranyagarbha.
17	Sarpa ...	<i>Om ṇamo' stu sarpebhyo, &c.</i> ...	Devás.
18	Brahmá ...	<i>Om brahmaya jñānam, &c.</i> ...	Prajápati.

The Pratyadhidevatás.

19	Rudra ...	<i>Om tryambakam, &c.</i> ...	Vaśiṣṭha.
20	Umá ...	<i>Om śrís cha te laksmí, &c.</i> ...	Uttaranśráyaṇa.
21	Skanda ...	<i>Om yadakraṇḍaḥ prathama m &c.</i> ...	Bhārgava, Jamadagni and Dirghatamasa.
22	Purusha ...	<i>Om sahasra-śirśa puruṣaḥ &c.</i> ...	Asyanāśráyaṇa.
23	Brahmá ...	<i>As in 18</i> ...	As in 18.
24	Indra ...	<i>Om trātāram indram, &c.</i> ...	Gārgya.
25	Yama ...	<i>Om asi yamaḥ, &c.</i> ...	As in 21.
26	Kála ...	<i>Om kārshirasi, &c.</i> ...	Ditto 15.
27	Chitragnpta, ...	<i>Om chitrávaso, &c.</i> ...	Ditto 4.

Other deities.

28	Vináyaka ...	<i>Om gaṇḍān twá, &c.</i> ...	As in 18.
29	Durgá ...	<i>Om jātavedase, &c.</i> ...	Kaśyapa.
30	Váyu ...	<i>Om vāto vámano vá, &c.</i> ...	Gandharvās.
31	Ākáśa ...	<i>Om ūrdhvaḥ, &c.</i> ...	As in 18.
32	Áśvinau ...	<i>Om yávánkuśa, &c.</i> ...	Medhātithi.

Dīkpálás.

Sesamum and clarified butter are here added to the offering of *paláśa*.

33	Indra ...	<i>As in 24</i> ...	As in 24.
34	Agni ...	<i>Ditto 10</i> ...	Ditto 3.
35	Yama ...	<i>Ditto 25</i> ...	Ditto 21.
36	Nirṛiti ...	<i>Om eṣate nirṛite, &c.</i> ...	Varuṇa.
37	Varuṇa ...	<i>Om imam me varuṇa, &c.</i> ...	Sunāśeṣha.
38	Váyu ...	<i>As in 30</i> ...	As in 30.
39	Kuvera ...	<i>Om vaya gvaṃ, &c.</i> ...	Bandhurishi.
40	Íśāna ...	<i>Om tam íśānam, &c.</i> ...	Gautama.
41	Brahmá ...	<i>As in 18</i> ...	As in 18.
42	Sarpa ...	<i>Ditto 17</i> ...	Ditto 17.

Should any error occur in naming the deities in the order above given, the entire ceremony must be gone through again, but no penalty

is attached to the use of the materials for the *samidh* in other than the prescribed form.

The position assigned to each deity on the *graha-vedi* will better be understood from the diagram in Plate, I, fig. 2. In the petals of the lotus, the letter 'A' stands for 'Adhideva': the letters 'Pradh' for 'Pradhāna-deva' and the letters 'Pr.' for 'Pratyadhideva,' the titles given to each triad. We have next a *homa* of clarified butter with the *vyākṛiti*-mantra repeated nine times: hence the name *navākṛiti-homa*. Another offering of clarified butter is made with the mantra:—'Om to Agni who causeth a good sacrifice *śākhā*.' Then a *pūrṇa-pātra*, or vessel, is presented to the celebrant with a dedication that all imperfections in the ceremony may be forgiven and the rite be completed.

Balidāna.—The *balidāna* follows and comprises offerings of milk or rice and curds to the north of the *graha-vedi* or near the *homa-vedi*. A portion of the mixture is taken and placed on a brazen platter or stone in the name of the sun with the address:—'Bhó bhó Sun accept this offering; be thou the bestower of long life, the giver of forgiveness, the alleviator of trouble, the giver of good fortune and the increaser of prosperity to thy worshipper.' Above this an offering is placed for the moon with the same address and so on for each of the forty-two deities assembled and to whom a *homa* has been offered. It will be noticed that a *homa* is not offered either to the Kshetrádhpati or the Vástoshpati. To the former, however, a *bali* is presented with considerable ceremony; a mixture of clarified butter and rice known as *khichrī* is placed on a platter of leaves and on it four lamps of wheaten dough with clarified butter for oil and a few coins. Then an ignorant Bráhmaṇ or a Sudra is honoured with an offering of sandal which, as a rule, is smeared over his face to make him look hideous. The *dhyāna* or meditation on Kshetrápála follows, after which the offering is taken and presented with the mantra.* "Om glory to the venerable Kshetrápála * * * to all sprites, goblins, demons and their followers, glory to this offering of clarified butter and rice with its light, gifts and betel. Hail Kshetrápála * * filled with the howling of the fierce-mouth protect me, eat this offering of *khichrī* with its light prepared for thee. Protect the person who causes this

* *Om namo bhagavate kshetrápáldya* वां वीं वूं वें वौ वः *bhūta-preta-piśācha-
dākinī-tākinī-betāldī-parivārayutdya* esha *sālpah sadakshināḥ satāmbūlaḥ kṛisārānna-
balir namaḥ bho bho kshetrápála maru maru, turu turu, lala lala, shasha shasha, phen-
kāra-pūrita-dīnmukha raksha raksha grahamakhakarmmani amum sadāpam kṛisārānna-
nabalim bhaksha bhaksha yajamānam pāhi pāhi mama vā saputra-saparivdrasya yaja-
mānasya vā, &c.*

ceremony to be made, be for him and his child and those belonging to him, the bestower of long life." &c.

Pūrṇāhuti-homa.—After this follows the *pūrṇāhuti-homa* in which Bharadvāja is the Ṛishi and the deity is Mahāvaiśvānara. The offering is prefaced by the usual dedication of time, place, person and object, followed by the hymn in four verses beginning:—‘*Oṃ mūrdhdhānam dīvo,*’ &c., and ending with ‘*Oṃ pūrṇā,*’ &c., whence the name.

Agni-pūjā.—The *Agni-pūjā* comes next in which Agni is addressed on behalf of the boy:—‘*Oṃ Agni thou that protectest the body, protect my body; Oṃ Agni that grantest long life, grant me long life; Oṃ Agni that bestowest energy, bestow on me energy; complete whatever is deficient in my oblation; Oṃ holy Savitā, accept my sacrifice, holy Sarasvatī accept my sacrifice; ye, twin Aśvins, crowned with lotuses accept my sacrifice.*’ Then warming his hands in the flame of the altar he applies them in succession to the various parts of his body saying:—“May each member of my body increase in condition.” Similarly the mouth, nostrils, eyes, ears and arms are separately addressed to the same intent.

Tryāyusha.—After this, the rite called *tryāyusha* for acquiring the three-fold vital power is celebrated. It consists in the application of the *tilaka* or frontal mark to the head and throat of both the boy for whom the ceremony is performed and his father. The material for the *tilaka* is taken from the ashes of the *homa* and then mixed with clarified butter and applied by the celebrant. This is followed by the distribution of gifts which are divided amongst all the Brāhmins present. But in addition to the ordinary presents suitable to the occasion, the wealthy and devout are instructed that the following are specially acceptable to each of the nine planets:—to the sun, a brown cow; to the moon, a conch; to Bhauma, a red bullock; to Budha, gold; to Vṛihaspati, yellow clothes and gold; to Śukra, a white horse; to Śani, a black cow; to Rāhu, a sword, and to Ketu, a goat. These subsequently become the property of the officiating priests, but it is allowed to commute these gifts in detail for a sum of money which is made over to the priests with the usual dedication of place, time, person and object, and that the money is in lieu of the gifts due to each of the nine planets. All then march around the altar singing:—“*Oṃ, go, go, best of gods, omnipotent, in thy own home, where Brahma and the other gods are, there go thou Hutāśana.*” The planets are then worshipped and afterwards the celebrant and his assistants asperse the assembly with water taken from the *kaśāsa* whilst chaunting a hymn.* This is followed by a mantra† in

* This is called a Vaidik hymn and commences:—‘*Oṃ sarve samudrāḥ saritas tīrthāni jalādānadāh,*’ &c.: it contains thirty-four verses.

† Called a Paurāṇika-mantra.

which all the deities are invoked that the aspersion may be fructuous and their protection be extended to all. The *tilaka* of sandal is then given by the celebrant to the men of the assembly with the mantra* :—" *Oṃ*, may it be well with thee, be thou fortunate; may *Mahá-lakshmí* be pleased with thee; may the gods always protect thee; may good fortune be always with thee everywhere; may evil planets, sins, impurities and causes of quarrel seeing the mark on thy forehead be powerless to harm thee." The rice is applied with the mantra :—" *Oṃ* may this rice protect thee." The *tilaka* is given to women merely as an ornament without any mantra, but the rice is applied with the mantra used for men. The mantra-*páṭha* follows, of which twenty-one verses are for the men and three for the women whose husbands are alive at the time; when finished, flowers are distributed to all present. After this the ceremony of fastening on the bracelet (*rākshābandhana*) takes place as described, and the *bhūyasí-dāna* with its gifts in which all the dancers and the musicians share. The worship of the planets concludes as usual with a feast to Bráhmans.

Chúrá-karaṇa.—The rite known as *chúrá-karaṇa* or shaving of the head is also included amongst those preparatory to the assumption of the sacrificial thread. The favourable moment is fixed by the family astrologer and when arranged for, the father of the boy commences the rite the night before by going through the *Gaṇeśa-pújá*. He then takes ten small bags of cloth and wrapping up in them portions of turmeric, *dúb*-grass, mustard and a coin, ties them in the hair of the boy with the mantra :—"To-morrow you will be cut off," &c. Three are tied on the right side of the head, three on the left side, three at the back of the head and one on the top. The next morning all proceed to the *yajña-śála* in which the *graha-vedí* of the previous ceremony was erected. The duties of the day are opened with the rinsing of the mouth, next the *argha* is set up and consecrated and the *pránáyama* is gone through followed by the dedication.

In the last rite, the celebrant defines the object by stating that the ceremony is performed for the *chúrá-karaṇa* and *upanayana* (initiation) of so and so, the son of so and so, &c. Next follow the whole of the usual preparatory ceremonies as far as the *Puṇyáha-váchana*. The celebrant now approaches the *chúrá-karaṇa-vedí* and again consecrates the *argha* and makes a dedication to Agni and then lights a fire upon the *vedí* or altar. The father now takes the boy in his arms and the mother seats herself to his left, and all assist in the installation of the altar and the invitation, &c., is gone through as before. Then an offering of clarified butter is thrown on the fire with the mantra :—" *Oṃ prajāpa-*

* *Oṃ bhadramas tu, &c.*

taṣe, &c., and gifts are bestowed on the celebrant. The hair of the child, except the top-knot, is now cut off whilst an appropriate service is read. The hair is then buried with cow-dung near some water and the boy is bathed and clothed in his best and placed near the celebrant and is held to be entitled to the name *mānavaka* or religious student. The ceremony as usual winds up with gifts to the celebrant and assembled Brāhmins, replied to by a mantra and the gift of a flower (*śiṣha*) as a benediction.

Assumes the garb of a student.—According to the *Pāraskurasūtra*, the son of a Brāhman may assume the *janeo* at seven or eight years of age, the son of a Kshatriya at eleven years of age and the son of a Vaiśya at twelve years. These limits can be doubled where necessity exists, but the ceremony cannot take place after the second limit has expired. The father and son now approach the *upanayana-vedi* and the boy presents the *tilapātra* to the altar. This *tilapātra* is an iron pot containing sesamum oil in which coins have been placed and which form a portion of the honorarium of the celebrant. The invitation, &c., is again recited and the dedication is made to ensure the success of the young student in his studies. Next follows a formal burnt-sacrifice of clarified butter. The celebrant then receives from the father of the boy a loin-cloth, belt, sacrificial-thread, waist thread, walking-stick and bason for receiving alms and gives them one by one to the boy with the mantra for each. Separate woods are prescribed for the walking-stick according to caste; for the Brāhman, *palāśa*; for the Kshatriya, *bel*; and for the Vaiśya, *gular*. The celebrant then asperses the head and breast of the boy and accepts him as one duly prepared and fit to be raised to the degree of a religious student. The boy next seats himself to the north of the celebrant and his father goes through the *Agni-pūjā* and offers a sacrifice of clarified butter and presents gifts to the Brāhmins. The title *bhaṭṭa* is given to the student who has assumed the sacrificial thread.

Saluting the religious preceptor.—The astrologer fixes the *lagnadāna* or propitious moment for repeating the *gāyatrī*, and when it comes the boy seats himself in front of the celebrant and turning his face towards the north-east salutes the celebrant and presents gifts to his *purohita*. He then crosses his arms and places his right hand on the right foot and his left hand on the left foot of the *purohita* and bows his head down until it touches his hands. The *purohita* then gives the *śiṣha* and for a Brāhman reads the *gāyatrī* three times, thus:—

- (1) *Om bhūr bhuvaḥ svaḥ tat savitur vareṇyam.*
- (2) Repeat first line adding *bhargo devasya dhīmahi.*
- (3) Repeat both preceding and add *dhiyo yo naḥ praçhodayāt.*

The Kshatriya *gāyatrī* is as follows :—

Oṃ devasya savitur matim āsavaṃ viśvadevyam dhiyā bhagaṃ mānāmahe.

The Vaiśya *gāyatrī* is as follows :—

Oṃ viśvā rūpāni prati munchate kaviḥ prāsāvid bhadram dwipade chatushpade vi nākam akhyat savitā vareṇyo 'nu prayānam ushaso virājati.

The boy again brings presents and falls at the feet of his *purohita* and prays that with his teacher's aid he may become a learned man. The *purohita* then instructs his pupil in the *sandhyā*, already described. Next the *samidh* or small faggot of sticks from five trees previously mentioned is taken by the boy and with one of the pieces he touches his eyes and then dips one end of it in clarified butter and again the other and then places it on the fire on the altar. Similarly the ears, nose, hands, arms, forehead, lips, and breasts are touched in order and the stick are burned. The celebrant then performs the *tryāyusha* by applying the frontal and throat-marks with the ashes of the *homa* and clarified butter. The boy then goes through the *daṇḍawat* or salutation as already described and again receives the *śiśha*. He then addresses Agni, stating his name, caste, parentage, &c., and asks the deity to take him under his protection and again prostrates himself before his *purohita*, who usually delivers a homily on general conduct. The boy then begs from his friends and presents the results to his *purohita* saying :—" O Mahārāja accept these alms which I have received."

Vedārambha.—Then commences the rite connected with the first study of the Vedas, the *Vedārambha*. Gautama has said that the Veda of the division to which the student belongs should first be read by him. The celebrant prepares the altar called the *Vedārambha-vedī*, for which the usual Gaṇeśa-*pūjā* is performed and a fire is lighted thereon. The flame is then fed with the numerous offerings made in the names of the deities invoked to be present and assist, for whom the whole invitation, &c., is repeated, followed with the usual gifts and dedication. Then comes the worship of the Vedas themselves with invitation, &c., followed by the worship of Gaṇeśa, Sarasvatī, Lakshmi and Kātyāyana, accompanied with the usual installation address (*pratishṭhā*), invitation, &c. Then the boy looking towards the north-east performs the *prāṇāyāma* and recites the *gāyatrī* and mantras in honour of the four Vedas, commencing with that belonging to his own division. He next recites the *mahāvāhṛiti* with the *gāyatrī* three times, i. e., the *gāyatrī* with the *namas-kāra* :—" *Oṃ bhūr, Oṃ bhūvaḥ, Oṃ svaḥ.*" He is then told to go to Benares and study there and for form's sake actually advances a short distance on the road and then returns, when the ceremony is closed with the usual distribution of gifts.

Samāvartana.—Next comes the *samāvartana* (returning home after finishing his studies) which commences with the gift of a cow to the celebrant. The boy takes hold of the cow's tail with one hand and holding water in the other repeats a short formula and gives the cow to the celebrant. There is in this rite also an altar or *vedī*, the consecration of which takes place exactly as in the previous rite. The father, son and celebrant approach the altar and the son coming forward and laying hold of his right ear with his left hand and his left ear with his right hand (*vyastapāni*) says, he has ceased to do evil and wishes to learn to do well. The celebrant answers "may you have long life." The celebrant then asperses the boy and his relatives from the water of the *udakumbha* or small vessel for holy-water usually placed near the *kalaśa*, and subsequently takes whatever water remains and pours it through a metal sieve called *sahasradhārā* on the head of the boy. These operations are each accompanied by a mantra, as also the taking off of the belt (*mekhala*) and the applying of the *tilaka* to the twelve parts of the body:—(1) the forehead in which Keśava resides; (2) the belly with Nārāyaṇa; (3) the heart with Mādhava; (4) the right side with Viṣṇu; (5) the left side with Vāmana; (6) the hollow below the throat with Govinda; (7) the right arm with Madhusūdana; (8) the left arm with Śrīdhara; (9) the root of the ears with Trivikrama; (10) the back with Padmanābha; (11) the navel with Dāmodara, and (12) top of the head with Vāsudeva. The boy then clothes himself, and the celebrant repeating appropriate mantras directs the boy to remain pure for three whole days, i. e., not touching a Sūdra or a dead body, &c. On the fourth day they again assemble, and the *homa* known as *pūrṇāhuti* is made, and again the entire ceremony of consecrating the *graha-vedī* is gone through as well as the worship of the nine planets and *jīvanātṛis*, and the boy's sister or mother performs the *muhāntrājana* (waving of lights) before him, and all winds up with the usual gifts and a feast.

Vivāha-karma.—The ceremonies connected with marriage come next and occupy no inconsiderable place in the services. They include those arranged in the following five divisions:—

- (1) *Agni-pūjā*; clothing, perfuming and anointing the body; the *purohita* of the boy shall then ask the other the name and caste of the girl and communicate the same information regarding the boy.
- (2) Presentation of a cow and coin in honor of the girl: procession from the house to the *agni-vedī*.
- (3) Invitation to the father of the bride and formal conclusion of the arrangements; then circumambulation of the fire-altar and performing the *kūśa-kandikā*.

- (4) The bride sits to the right, and the bridegroom sits to the left close together, while a *homa* is made.
- (5) Next follows the *saṁśrava-prásana*, *pūrnápátra*, gifts to Bráhmans, and the verses suited to the ceremony.

Vágdána.—Commencing with the first group we have the *vágdána-vidhi* or rules for the preliminaries to a marriage. Some days before the wedding takes place the father of the girl performs the Gaṇeśa-pújá and the dedication declaring the object to be the correct and successful issue of the *vágdána*, with detail of his own caste, name, race, and that of the boy to whom he has given his girl. The girl then performs the Indráṇi-pújá (one of the divine mothers) before a likeness of that deity drawn on gold or other metal. Next day the *sarvvárambha* or the beginning to collect the materials necessary for the wedding takes place. The father of the bride takes a mixture of turmeric and *láhi* (parched grain) with water and anoints the body of the girl and performs the Gaṇeśa-pújá. The same is done by the father of the boy to the boy, and in addition he takes three small bags (*poṭalí*) of cloth containing coin, Betel, turmeric, *roli* (powder on the seeds of *Mallotus phillipinensis*) and rice,* one of which is buried within the hearth where the food is cooked; a second is suspended from a handle of the *karáhi* or iron-pan in which the food is cooked, and the third is attached to the handle of the spoon. The object of these proceedings is to keep off ghosts and demons from the feast. Thin cakes are prepared of wheaten flour (*sunwála*) and thicker cakes (*púri*) of the same, which, with sesamum and balls of a mixture of rice-flour, ghí, and molasses (*laddú* and *chhol*) are made by the women.

First visit.—Next comes the *púrvánga* which takes place on the day before or on the morning of the wedding. The parents of both children, each in their own house, commence with the Gaṇeśa-pújá, followed by the Mátri-pújá, Nándi-śráddha, *Punyáha-váchana*, *Kulaśa-sthápana* and *Navagraha-pújá* as already described. The parents of the girl seldom perform more than the first two, and remain fasting until the *Kanyá-dána* has taken place. The father of the girl then through his daughter adores Gaurí, Maheśwari, and Indráṇi, and ties a *poṭalí* on her left hand. The father of the boy binds a similar bag on the right wrist of the boy, and also on the left hand of the boy's mother. Four days afterwards the bags are removed. On the morning of the wedding day the family astrologer sends a water-clock, to mark the exact moment, with other presents to the father of the girl, and declares his intention of being present with the marriage procession at a certain hour. The boy is then

* These are the contents of the *poṭalí* commonly used, though a much more elaborate inventory is given in the ritual.

dressed in his best, perfumed, anointed, and painted and placed in a palanquin, and, accompanied by the friends of the family and musicians, he sets out for the bride's house. He is met on the road by a deputation from the bride's father, conveying some presents for the bridegroom, and near the village by a relative of the bride, who interchanges further presents. The procession then halts for rest whilst dancers and musicians exercise their craft. All then proceed to the house of the bride, where a clean-swept place opposite the principal entrance has been decorated by the women of the family with rice-flour and red sanders. On this place the celebrant and parties to the ceremony with their fathers and principal relations take their place, whilst the remainder of the procession stand at a respectful distance. Next comes the *dhūlyargha* which commences with the consecration of the *argha*. Then the father of the bride recites the *baraṇa sankalpa*, dedicating the rite to the giving of his daughter to the bridegroom, after which he offers the water of the *argha* to the celebrant who accompanies the bridegroom, as well as water for washing his feet, the *tilaka* with flowers and rice, and the materials necessary for the ensuing ceremonies. Similar offerings are made to the bridegroom; and his father is honoured with flowers and the *āsisha*, and all sit down to a feast.

The marriage hall.—The near relatives of the parties then assemble in the marriage-hall. The bride is placed looking towards the west and the bridegroom towards the east with a curtain between them, whilst the fathers of each perform the *Gaṇeśa-pūjā*. The bridegroom's father sends a tray of sweetmeats (*laddū*) to the girl's father, on which the latter places flowers and returns the tray to the boy's father. The bride's father then washes the bridegroom's feet and fixes the *tilaka* on his forehead. Again the girl's father sends a tray of sweetmeats which is accepted and returned adorned with flowers. The bridegroom then performs the *āchamana* and receives from his father-in-law a tray of sweetmeats (*madhuparka*) made from honey, &c. He should then taste a portion of them, and say that they are good and express his thanks for the present. He then washes his hands and rinsing his mouth performs the *prāṇāyāma* and sprinkling of his body with the right hand merely and the usual mantra. The bride's father takes a bundle of *kusa* grass in the form of a sword and calls out "bring the calf:" the bridegroom says, "it is present."* Then water is sprinkled over the figure of the calf and several mantras are read, and as in the Kali-Yuga the slaughter of cows is prohibited, the figure is put aside and gifts are substituted.

* As a rule in Kumaon, the figure of a calf made in dough or stamped on metal is produced.

Verification of family.—In the meantime, a Bráhmaṇ of the bridegroom's party prepares the altar, consecrates it, and lights the fire. The bride's father then gives four pieces of cloth to the bridegroom and he returns two for his bride. The bride's father then raises the curtain and allows the parties to see each other. Then the celebrant on the girl's side, after reading the *ásirváda* verse,* asks the celebrant on the boy's side the *gotra*, *pravara*, *śákhá*, *veda*, ancestors for three generations, and name of the boy. The celebrant on the boy's side recites a similar verse and replies to the questions asked, winding up with a request for like information as to the girl's family, which is given. The questions and answers are repeated three times, the verses alone being changed. This section of the rite winds up with the usual gifts, and dedicatory prayers and a *homa* of four sweetmeats, two from the bride's house offered by the bridegroom and two from the bridegroom's house offered by the bride.

The giving away.—At the exact time fixed for giving away the girl, the bride's father turns his face to the north, whilst the bride looks towards the west. The father then extends his hand and the girl places her hand (palm upwards) in her father's hand with fingers closed and thumb extended, and holding in the palm *kúśa*-grass, sesamum, barley and gold. The boy takes hold of the girl's thumb, whilst the mother of the girl pours water on the three hands during the recital of the dedication by the celebrant. This portion of the rite concludes with the formal bestowal of the girl generally called the *kanyá-dána*. When this is concluded the girl leaves her father's side of the hall and joins her husband, when the *dánavákya*† is read, and the father of the bride addresses her and prays that if any error has been committed in bringing her up it may be forgiven. Next an address with offerings is made by the bridegroom to his father-in-law, thanking him for the gift of his well-cared-for daughter. In return the father declares the girl's dowry, and the clothes of the two are knotted together. Then come the usual gifts, aspersion, and offering of flowers. The bride and bridegroom then proceed to a second altar‡ which is usually erected outside the marriage hall and whilst mantras are recited by the celebrant circumambulate the outer circle.

The circumambulation.—This being done the *ághára-homa* follows, which comprises twelve offerings conjointly made by bride and bride-

* In praise of Hara and Hari.

† Containing four verses from the Puráṇas.

‡ This altar is about a cubit square and is surrounded by a hedge of branches of the sacred trees connected together with twine, outside which the circumambulation takes place either three, five, or seven times.

groom, the former of whom holds her husband's arm whilst he places each offering on the altar and the celebrant recites the prescribed prayers. Next come the usual gifts and returns in flowers and rice. Then follows the *rāshṭrabhṛit-homa*, which also consists of twelve offerings, conjointly made, winding up with presents as before. Also the *jayā-homa* with its thirteen offerings, the *abhyātāna-homa* with its eighteen offerings, the *pañchaka-homa* with its five offerings and the *lājā-homa* with its offerings of flowers and fruit. Then the altar is again circumambulated and parched rice sprinkled from a sieve on the pair as they move slowly around. The bridegroom then lifts the bride and places her a short distance apart, when her brother approaches and gives her some parched rice with which she makes a *homa*. The bridegroom then asperses his bride with water from the *kalāśa* whilst repeating the mantra:—"Om āpaḥ Śivāḥ śivatamāḥ," &c., and also touches her chest and head with appropriate mantras. She then goes to the left of her husband and lays hold of his garments, and whilst another mantra is read, the *brahma-homa* is made by the bridegroom. The bride then washes her husband's feet, who in return makes her a present, and each applies the *tilaka* to the other and eat curds and molasses together. After washing of hands the *pūrṇāpātra* takes place, in which forgiveness is craved for all defects in the ceremony or in the amount of gifts, &c., and the *mantra-patra* or leaf is placed on the bridegroom's head by the celebrant with the prayer that he may be well and have long life, and for this the celebrant is again rewarded. Then follows aspersion, the giving and receiving of the *tilaka*, &c., and the bridegroom is told to look well at his bride. A homily is now given regarding their conduct, the one towards the other, that they should above every thing keep themselves pure for three nights or until the *chaturthī-karma* had taken place. The party then proceed in doors and the *Gaṇeśa-pūjā*, *jivamātri* and *vasoddhāra* rites are performed; the *mahānirājana* also takes place by the bride's mother, who presents sweetmeats and opening the knot in their garments gives a portion of the sweetmeats to both bride and bridegroom, who then retire.

Dwāra-mātri-pūjā.—Next morning the young married couple arise early and after domestic worship again tie their garments together and perform the *dwāra-mātri-pūjā* at the bride's father's home. The door-leaf is cleaned with rice flour and on it figures of the *Mātris* are drawn and revered conjointly, the bride assisting by holding her husband's arm. Again she alone prepares the threshold and performs the *dehaliya-pūjā*, by sprinkling rice and flowers. After breakfast both proceed to the bridegroom's house, where in the presence of a child who bears on his head a small lotā of water with a green branch on it, indicative of prosperity, he formally commits his wife and her dowry to the safe keeping

of his mother. The *dwára-mátri-pújá* again takes place and after entering the house the *Gaṇeśa-pújá* is performed with the dedication that the moment may be propitious and the usual gifts, &c., winding up with the *mahánirájana* by the sister of the bridegroom and the aspersion of the assembly by the celebrant. After this gifts are distributed and all the attendants are permitted to disperse.

Chaturthi-karma.—On the fourth day the *chaturthi-karma* takes place, which consists of the usual preparatory ceremonies followed by the removal of the *potali* or small bags from the wrists of the bride and bridegroom preceded by a *homa púrṇapátra* which concludes the ceremony.

Dvir-āgamaṇa.—The next ceremony is the *dvirāgamaṇa* or 'second-coming.' The instructions direct that on a propitious day the boy's parents shall cook certain cakes called *phenika* and placing them in a basket, the boy proceeds with them to his father-in-law's house, where he salutes all the family and presents the food. Early in the morning he performs the *Gaṇeśa-pújá* and at a favourable time places his wife near him. The *tilaka* is then interchanged between him and the relatives of his wife and formal salutations take place. He then takes his wife and whatever portion of the dowry that is now given to his own house, and on arriving at the threshold the garments of both are again knotted together. Both are then seated together and the husband rinses his mouth, consecrates the *arṇha* and performs the *prāṇāyāma* and dedication to the *dvirāgamaṇa* and the *dwára-mátri-pújá*. *Gaṇeśa* and the *Mātris* are then worshipped and the fixing of the favourable time is again gone through that the whole rite may be undertaken at the auspicious moment and be free from defects. Gifts are then made to the family *purohita* and astrologer as if to the deity, and the couple go within while the *svastivāchana* is read. On entering the inner apartments the young couple worship the *Jīva-mātris* whose figures are drawn on the walls. The *kalāśa* is then consecrated and the couple circumambulate the vessel and the usual offerings and dedication are made; winding up with the aspersion, after which the knots on the garments are untied and the couple feast and retire to rest.

Arka-vivāha.—Should any one desire to marry a third time, whether his other wives are alive or not, he must go through the ceremony known as *arka-vivāha* or marriage to the *arka* plant (*Calotropis gigantea*). The aspirant for a third marriage either builds a small altar near a plant of the *arka* or brings a branch home and places it in the ground near an altar. He then goes through all the preparatory ceremonies and also the *Sūryya-pújá* with its invitation, &c., and *prārthana* or adoration with hands clasped and appropriate mantras. He then circumambulates the altar and asks the caste, &c., as in the regular ceremony; a *purohita*

answers on the part of the *arka* that it is of the Kaśyapa gotra, the great-granddaughter of Aditya, the granddaughter of Sava and the daughter of Arka; then follows the caste, name, &c., of the real bride. A thread is then wound ten times around the *arka*, accompanied each time by a mantra, and again around the neck of the *kalāśa*. To the north of the *arka*, a fire-altar is raised and the *āghāra-homa* is made to Agni with gifts and dedication. Next comes the *pradhāna-homa* with the mantras, "*Oṃ sangobhiḥ*" and "*Oṃ yasmaitvákā*;"* the *vyāhṛiti-homa* with its own mantra and the *bhūrādi-navāhuti-homa* with its nine mantras closing with the *pūrṇāpātra* and dedication. After this a second circumambulation follows and a prayer and hymn. Four days the *arka* remains where it has been planted, and on the fifth day the person is entitled to commence the marriage ceremonies with his third wife. If, however, she be already a widow, he can take her to his home without any further ceremony.

Kumbha-vivāha.—The *Kumbha-vivāha* or marriage to an earthen vessel takes place when from some conjunction of the planets the omens for a happy union are wanting, or when from some mental or bodily defect no one is willing to take the boy or girl.* The ceremony is similar to the preceding, but the dedication enumerates the defects in the position of the planets in the worshipper's horoscope and states that the ceremony is undertaken to avoid the malign influences of the conjunction of the adverse planets or of the bodily or mental defects of the native as the case may be. The nine planets are honoured and also Vishṇu and Varuṇa, whose forms stamped on a piece of metal are amongst the furniture of the ceremonial. The *anchala* or border of the garment used in the knot-tying is represented by connecting the neck of the girl or boy with the neck of the vessel, when the aspersion is made from the water of the *kalāśa* with a brush made of the five leaves.

Casual ceremonies. On killing a snake.—Several ceremonies are prescribed for alleviating (*sānti*) the evil effects of accidents, bad omens, portents, unlucky acts, &c., which may be briefly noticed here. Thus, if in ploughing, the share injures or kills a snake, a short ritual is prescribed to appease the lord of the snakes. Gaṇeśa, the Mātṛis and Kṣhetrapāla are first worshipped on the spot: then the figure of Mrityuñjaya is drawn on cloth and with it that of the snake-god, and both are worshipped with the invitation, &c., and the *sarpa-mantra* is recited and a *homa* made.

Death of a plough-bullock.—One-sixteenth of the value of the cattle

* The *Vishṇu prātimā-vivāha* is similar to the *Kumbha-vivāha*. The girl is first married to a picture of Vishṇu in order to avert the influence of the planets when the conjunction of the latter would show her to become a widow or a bad character.

should be paid as a *devadaṇḍa* to Brāhmins. Another ceremony known as the *vrishabha-patana* takes place when a bullock dies or is injured while ploughing.

Unlucky conjunctions.—It is believed that if the *megha-sankrānta* comes within the conjunction of the planets noted in the horoscope, the native will die within six months, and similarly if the *tūla-sankrānta* come within the horoscope the native dies before the next *megha-sankrānta*: to avert these evils a special ritual is prescribed in which Govinda is the principal deity invoked. A more elaborate service takes place on the occasion of an eclipse when numerous articles are placed in the *kalāśa* and the image of the snake-god stamped on metal is worshipped and the usual gifts are made.

Born again from a cow's mouth.—The ceremony of being born again from the cow's mouth (*gomukha-prasava*) takes place when the horoscope foretells some crime on the part of the native or some deadly calamity to him. The child is clothed in scarlet and tied on a new sieve which is passed between the hind-legs of a cow forward through the fore-legs to the mouth and again in the reverse direction signifying the new birth. The usual worship, aspersion, &c., takes place and the father smells his son as the cow smells her calf. This is followed by various burnt-offerings and the usual gifts, &c.

Dentition, &c.—Ceremonies are also prescribed when the teeth are cut irregularly, when the father and son are born in the same lunar mansion, when three children are born at the same time or in the same lunar mansion, when snakes are seen *in coitu*, when a dog is seen during a ceremony, when a crow evacuates on one's clothes, on seeing a white crow, when gifts of land, money or grain are made, and when building a house, &c.

Mūla-nakshatra.—The misfortunes that are supposed to follow any one born in the *Mūla-nakshatra*, which is presided over by Nirṛiti, the goddess of evil, are such that the parents are advised to abandon such a child, whether boy or girl, or if not, to go through the ritual prescribed for the occasion with great care and circumspection. The *Mūla-sānti* commences with the *Gaṇeśa-pūjā* followed by the setting up of the *argha* and the dedication. The sesamum, *kūśa*, barley and water are taken and the *pradhāna-sankalpa* is recited and also the *Mātri-pūjā*, *Punyāha-vāchana* and *Nāndī-śrāddha* are gone through. The celebrants are then appointed and duly revered and the person who causes the ceremony to be performed stands before them with the palms of his hands joined together in a submissive attitude and asks them to perform the rite according to rule. The celebrants consent and proceed to the *grihasālā*, or as usual in Kumaon to the place where the cows are tied up. A place

is selected and purified either with holy-water (i. e., water which has been consecrated by using the names of the sacred places of pilgrimage) or the mixture called *pancha-gavya*. To the south-west a hollow is made and a fire is lighted therein, and this is followed by the ritual contained in the formal appointment of the Bráhmaṇ to the aspersion. An altar is then made, and on the top a lotus of twenty-four petals is drawn and coloured and named as described below.*

A handsome metal vessel is then placed in the midst of the figure and four other vessels are placed one at each corner of the principal altar. A figure of Nirṛiti stamped on metal is placed in the centre of the altar on its vessel and small pieces of gold, silver and copper on the other vessels after having been washed with the five nectars applied with the usual mantras. Next comes the address to Nirṛiti prefaced by the *vyáhr̥iti* mantra :—‘Come hither and remain here O Nirṛiti mistress of the *Múla-nakshatra*, grant our requests and accept our reverence.’ Her companions and the twenty-four deities residing in the petals of the lotus are similarly invited with the same formula.

Three of the vessels are dedicated to Brahmá, Varuṇa and the nine planets who are invited to attend. Then the meditation on Nirṛiti and the deities to whom the altar is dedicated follows :—‘Nirṛiti, black in colour, of beautiful face, having a man as thy vehicle, protectress, having a sword in thy hand, clad in shining robes adorned with jewels.’ A similar short meditation on Indra and Toya is given and for the remaining deities, the recital of their names is held sufficient. Nirṛiti then receives the formal invitation, &c., with the mantra :—‘*Oṃ moshúṇa*,’ &c., whilst the others are merely named. Then those deities invited to occupy the three vessels above named receive the invitation, &c., and commencing with Nirṛiti all are in order worshipped with flowers, sandal and water. The vessel placed to the north-east of the altar is dedicated to Rudra, and on it are laid the five varieties of *svastika* and below it, a *droṇa* of grain. On the covered mouth of the vessel the image of Rudra

* The name on the petals is that of the initial letters of the *nakshatra* or lunar mansion, above which is the name of the regent of the mansion and below the colour which should be given to it. The names in order commencing with the mansion over which the *Vīśvadevās* preside are as follows :—

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|-----------------------|--------------------|----------------------|
| 1. Uttará-Ashárhá. | 10. Krittiká. | 19. Uttara-phalguní. |
| 2. Sravaṇa. | 11. Rohiṇí. | 20. Hastá. |
| 3. Dhanishthá. | 12. Mr̥ga-síras. | 21. Chitrá. |
| 4. Śata-bhishaj. | 13. Ārdrá. | 22. Svátí. |
| 5. Púrva-bhádrapadá. | 14. Punarvasú. | 23. Viśákhá. |
| 6. Úttara-bhádrapadá. | 15. Tishya. | 24. Anurádhá. |
| 7. Revatí. | 16. Āśleshá. | 25. Jyeshthá. |
| 8. Āsvini. | 17. Maghá. | 26. Múla. |
| 9. Bharapí. | 18. Púrva-phalguní | 27. Púrváshárhá. |

} In the middle.

stamped in metal is placed after being washed in the five nectars as before followed by the dedication, meditation, hymn of praise and invitation, &c. Then the *anga-nyása* to Rudra is repeated six times, and the *Rudrádhyáya*, eleven times, &c., &c. Next incense formed from the burnt horns of goats is offered to Nirṛiti and also wine, barley-cakes, flesh and the yellow pigment from the head of a cow (*go-rochandá*); flesh, fish, and wine, however, should not be used by Bráhmans, who should substitute milk with salt for wine and curds with salt for flesh. Lamps are now waved to and fro before all the deities and a fire is lighted on the altar and a *homa* made. Next the *ághára-homa*, the *kṛisara-homa*, the fifteen-verse *homa*. fuel, rice, &c., with the *śrí-śukta* mantra, the *páyasa-homa*, *púrṇá-huti-homa* and the *agni-homa*, are made, after which the fire on the altar is extinguished and Agni is dismissed. The vessel on the principal altar sacred to Nirṛiti is now filled with various materials and whilst these are stirred round several mantras are recited. The parents of the child and the child then bathe outside in a place prepared for the purpose and ornamented with *svastikas* and all are sprinkled with holy-water. Some hundred verses are then repeated with the prayer that the evil influences due to birth in the *Múla-nakshatra* may be effectually prevented. A similar ceremony is performed on account of any person born in the *Āśleśhá-nakshatra*.

(To be continued.)

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*On the Psychological Tenets of the Vaishnavas.*—By RA'JENDRALÁLA MITRA, LL. D., C. I. E.

What was the ontological doctrine which Chaitanya inculcated? is a question which was lately put to me by a distinguished European scholar. It is one which has not yet been discussed in any English paper that I am aware of. Nor is it well understood by the Paṇḍits of Bengal. Even among the Vaishnavas of the higher orders there seems to be considerable differences of opinion, and distinguished commentators on the Bhágavata and other leading texts of the Vaishnavas have propounded such contradictory and at times diametrically opposite theories that several polemical tracts had to be written on the subject. I have lately found one of these. It is entitled *Sarva-sampradáya-bheda-siddhánta*. In it an attempt has been made to reconcile the theories of the different sects of the Vaishnavas and of Sankara Áchárya. Its author's name is unknown to me, but the author was evidently a distinguished scholar, thoroughly conversant with the leading topics of Indian Philosophy and the various arguments which Vaishnavas of different schools brought to bear upon

the question. A brief analysis of the work may not, therefore, be unwelcome to the readers of this Journal.

The writer of the work naturally takes for granted that his readers are perfectly familiar with the values of the technical terms and the bearings of the various schools of thought in this country, and therefore plunges at once *in medias res*. This course, however, will not be convenient for English readers, and it is necessary, therefore, to preface this note with a few words on the leading Indian theories on soul, as a spiritual, self-conscious monad, distinct from the body, and concentrating in itself all the purest and most refined of human excellences—a spirit distinct from the entelechies of Aristotle.

These theories may be described under three heads: 1st, Nihilistic; 2nd, Monistic; 3rd, Dualistic.

The first is represented by the Chárvákas, who deny the existence of a soul. Like the Pessimists of this century they say there is no psycho. They hold that the soul, or the spiritual principle which vivifies and sensitizes living beings, is, like the body, derived from the parents, and dies with it. This means that vitality and consciousness are the results of organization, and cease with the complete ataxy of that organization. In other words, there is, apart from the body, no distinct essence, which, in association with matter, gives it life, and, dissociated from it, lives on, either to vitalize other bodies, or in an ethereal or spiritual form. The most essential attribute of this soul is its immortality, and most Indian philosophers add to it eternity, and these being wanting in the doctrine of the Chárvákas and other atheists, it is rightly called Nihilistic. One school of Buddhists, and that the most important, professes a modified form of this nihilism, allowing the soul functional existence for aëons, but reducing it to ultimate vacuity from which it is held to arise. This is called *Sūnyavāda*, 'the theory of vacuity,' or *Asadvāda* 'the theory of non-existence.' None of these, however, is accepted by any leading Vaiṣṇava school of thought, and need not, therefore, be noticed at greater length here.

The second head resolves itself into two divisions—1st, Generically Monistic; 2nd, Absolutely Monistic. Those who entertain the theory implied by the first division hold that every living being has a separate soul, which is uncreate and immortal. It is consciousness itself, and spiritual in nature, but defined in character, no one soul merging into, or bearing any relation to, another, and yet it is essentially so identical with one and another, that as a genus all souls are exactly alike, and as such there is perfect unity. Unity is also predicated of this soul on the ground of there being no species of soul of any other kind, and thereby is meant that there is no Divine or Supreme soul. In fact it is with a

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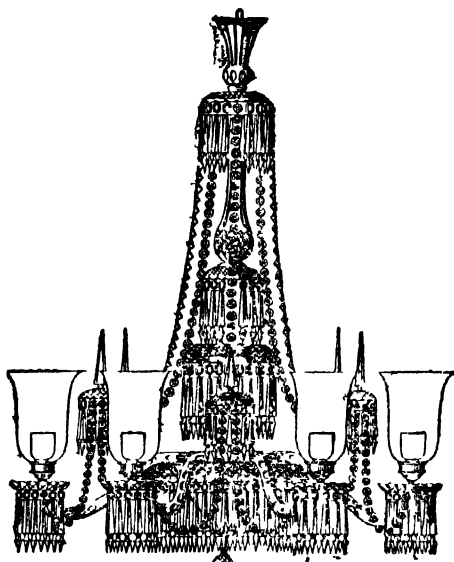


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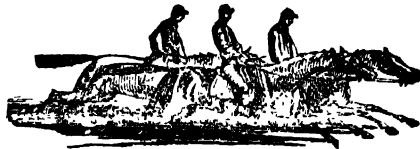
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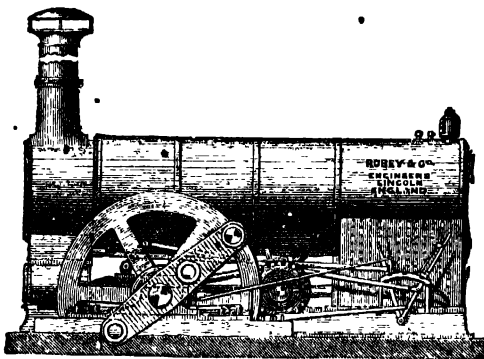
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view to deny a supreme intelligent Creator and Preserver of the universe that unicity is insisted upon in regard to the soul of created beings. The founders of the Sāṅkhya and the Jaina doctrines, as also some Bauddhas are the followers of this theory. They hold that this soul, though consciousness itself, is, in its ordinary state, so worked upon by its own energy (variously called *Māyā* 'illusion,' *S'akti* 'power,' *Prakṛiti* 'nature,' *ajñāna* 'ignorance,' &c., but meaning in reality the laws of nature) that it does not thoroughly perceive itself. It is the *ego* in a more or less latent, or potential, or mystified state, subject to various malign and beneficent influences which some times make it more and more mystified, and at other times less and less so; its aim, however, is to separate itself from its energy, or to shake off its unintelligent condition, and in course of time under the influence of its beneficent environments and earnest exertion gradually becomes more and more manifest, until at last its beclouding energy melts away, and the soul abides in its perfect purity. This melting of the energy may be compared, and in fact is substantially the same, with the progressive evolution theory of the modern European schools, except that the European Progressionists (or most of them) assume a beginning, or a first start, whereas their Indian congeners believe the universe to be uncreate and eternal. This state of perfect purity is the *summum bonum* which the Sāṅkhyas and the Jains look upon as *mukti* or final deliverance, and the Bauddhas as *Buddhahood* or *Nirvāṇa* 'perfect Intelligence,' or 'absolute quietude.' The goal of the Progressionist is thus eloquently summarised by Browning:—

“ I, that trace Providence without a break,  
I, the plan of things, drop plumb on this plain truth—  
That man is made in sympathy with man,  
At outset of existence, so to speak;  
But in dissociation, more and more,  
Man from his fellow, as their lives advance  
In culture; still humanity that's born  
A mass, keeps flying off, fining away,  
Ever into a multitude of points,  
And ends in isolation, each from each:  
Peerless above in the sky, the pinnacle,—  
Absolute contact, fusion all below  
At the base of being.”

Had Browning meant this for the Yogis, it would have been as correct as it is for the Progressionists, omitting only the first four lines in which the idea of Providence and first creation has been sketched, but

which do not at all bear upon the final "Isolation."\* The final stage in either case is a society of immortal beings, each physically, morally, and intellectually perfect, and from this perfection *ex concessio* identical. Some Indian writers do not, however, look upon this theory of unicity as satisfactory, and reckon the doctrine as a form of duality or *Dvaitavāda*. What they mean is that it is a system not of one, but of more than one, soul. This is true enough, and logically following it out, the term for it should imply plurality, and not duality, particularly in the Sanskrit language, where the dual does not mean plural. In the case of the Sāṅkhyas, it has further to be noted that they do not absolutely deny a supreme soul, but hold that there is no proof of the existence of such a being. In other words they are agnostics in this respect.

The Absolutely Monistic theory discards the idea of a separate individual soul for each being, as illogical and unphilosophical. Following the principle that two causes should not be assumed where one is sufficient, it repudiates the assumption of an uncountable number of soul monads, each uncreate and eternal, and holds a single soul, the Supreme Soul, as amply sufficient for all purposes. It is more consonant with reason, and at the same time it removes the stain of atheism which the preceding theory necessarily involves.

The idea of a spirit distinct from the body is of remote antiquity. In the earliest stage of human society every unintelligible phenomenon was accounted for by the assumption of a supernatural power or spirit, and the disposition of that spirit, as malevolent or beneficent, regulated the character of the phenomenon. This idea, once formed, multiplied rapidly, and every mountain and every plain, every wood and every tree, every pool and every river, was soon peopled by its appropriate spirit. These spirits could not, however, be accepted to be equally powerful, and in course of time and advancing reason, it was felt that the more powerful of these must be the rulers or governors of the less powerful, and the ultimate logical resultant was the assumption of one supreme God. God, thus evolved, did not negative the existence of the spirits and the soul of man, but took His place at the head of them all, and mankind at large was perfectly satisfied with this evolution. The theory did not, and could not, jar against their preconceived notions and universally spread beliefs, it bore no taint of atheism, and reason was in its favour. Philosophers, however, did not continue to rest satisfied. The process of thinking which brought them to one God pushed them still onward, and they at last abandoned the theory of separate souls for separate beings, whether

\* The Hindu idea of isolation will be found fully described in my translation of the Yoga Aphorisms of Patañjali.

human or celestial, and took to a single soul which gave vitality and consciousness to all. This is the theory of Absolute Unity, and is known under the name of *Advaitavāda* or the theory of 'Nonduality,' or 'Aduality.' From its very name it is obvious that it is subsequent to belief in Duality, or of one Supreme Soul on the one side and of many individual souls on the other. Had unity been the only idea to express, the term would have for certain been formed of a Sanskrit word implying *one*, and not a derivative of *two* with a negative particle before it. It was to exclude the idea of *two* which was current, that recourse was had to the circumlocutory forms of "not two" *adwaita*, "one without a second" *ekamevadvitīyam*, and so forth. These forms gave greater emphasis to the idea than what a simple statement of one would have done. Indeed, a term implying *one* would leave room for doubt as to whether the unity applied to the especial character of the soul or to its numerical individuality, and this is precluded by these negative forms.

The Upanishads dwell very largely on this idea. When Nachiketa, in the Katha Upanishad, repeatedly urges in varied phraseology 'I am that,' and Svetaketu, in the Chhândogya Upanishad, is told "thou art that," the idea conveyed is that the *ego* is no other than the Divinity himself. But the brief enigmatic way in which the theory was disclosed led to much misapprehension. And it was left to the renowned Śaṅkara Āchārya, the apostle of this school, to elaborate this Nondual or Aduality theory at considerable length in his great commentary on the Vedānta Aphorisms of Vyāsa. He would tolerate nothing that did not coincide in every detail with this cardinal theory, and he argued it out in very much the same form in which Berkeley worked out his celebrated theory regarding the essential non-reality of matter.

Śaṅkara, however, left it in a position which could not be final, and his followers could not rest satisfied at the point where he left it. The question soon arose as to, how does this Supreme Soul, one without a second, provide souls for the countless individual units of creation? To admit the theory of universal pervasion—of an infinite mass made finite by enclosing bodies, like the atmosphere enclosed in jars, which the followers of Śaṅkara developed at great length—was to admit a system of Pantheism, or animism, the *anima mundi* of Stahl, which was open to serious logical defects, and likewise inconsistent with the doctrine of faith which the Bhāgavadgītā had promulgated, and which got extensive currency a while before the time of Śaṅkara. Indeed Śaṅkara himself had felt this, and provided for it by a faint outline of a theory of shadow or reflection,—a shadow from the Great Soul forming individual souls. This is the doctrine of the Bhāgavata Purāṇa. Viṣṇu Svāmī, the founder of the Rudra-sampradāya, changed the shadow into a scintilla or

spark—something more substantial than a mere shadow—and worked it out into a regular system. This is called *S'uldhdvaitavāda*. It was further developed by Vallabha A'chārya, whose dogma has since degenerated into hideous licentiousness. The idea is, that since every individual soul is the Supreme Divinity, that soul should not be tortured by penance and privation, but fed and nourished and kept in an everlasting round of pleasures, and the result is a system of Epicureanism. Rāmānjan was not satisfied with this shadow or spark. He assumes that the Supreme Soul (Vishṇu as he names it) divides itself into a twofold form—a Supreme Spirit or *Paramātmā*, the cause, and a gross one, or effect, the individual soul units together with the universe or matter. This idea led him to the three categories, soul (*chit*), non-soul or matter (*achit*), and the Lord (*īśvara*). This tenet is called *Viśiṣṭādvaita* or 'qualified unicity.' Professor Wilson puts it thus:—

"Creation originated in the wish of Vishṇu, who was alone, without a second, to multiply himself: he said, I will become many; and he was individually embodied as visible and etherial light. After that, as a ball of clay may be moulded into various forms, so the grosser substance of the deity became manifest in the elements, and their combinations: the forms into which the divine matter is thus divided, are pervaded by a portion of the same vitality which belongs to the great cause of all, but which is distinct from his spiritual or etherial essence." (Works, I, pp. 43f.).

Nimbārka or Nimbāditya\* who founded the sect of the Sanakādi-sampradāya, went further, and promulgated the theory of distinct individual souls, or subordinate particles, ordinarily inferior but susceptible of fusing or subsiding in the Great Soul, so as ultimately to end in one. This is called *Dvaitādvaitavāda* or 'the theory of Dualistic Aduality.'

Professor Wilson thus summarises the tenets of this school: "Life, they say, is one and eternal, but dependent upon the Supreme and indissolubly connected with but not the same with him." (Works, I, p. 144). The Mahopanishad feels the difficulty of this position, and evades it by saying "as the birds and the string, as juices and trees, as rivers and oceans, as freshwater and salt, as the thief and his booty, as man and objects of sense, so are God and Life distinct, and both are ever undefinable."

These several ideas of shadow, reflection, scintillation, subordinate particles &c., occur in very ancient works, not excepting the Vedas, but

\* This is a nickname which was given to the saint because he once stopped the motion of the sun on the top of a Nimba tree (*Melia azadiracta*). His original name is not known. Dr. Wilson says it was Bhāskarāchārya, but I suspect this is not correct, for there is extant a commentary by Bhāskara Achārya on the Vedānta Sūtra, which is distinct from the commentary by Nimbārka on that work.

they are there very loosely and promiscuously put forth, without any serious attempt at philosophic precision. The authors named above were the first to give to each a scientific fixity and distinctness. It should, nevertheless, be mentioned that there is yet considerable misunderstanding current on the subject, and the three terms *Suddhādvaita*, *Viśiṣṭādvaita*, and *Dvaitādvaita*, are very carelessly used—the first according to some, is the same with *Advaita*, and the third is identified with the second. For the purposes of this paper it is, however, not necessary to attempt here any detailed exposition.

The last is the theory of Duality or *Dvaitavāda*, of one Supreme Soul and innumerable individual souls, essentially independent of each other. Its teacher was Mādhva Acharya\* *alias* Ananda Tīrtha *alias* Pūrṇaprajña or Pūrṇamandira, who wrote a short commentary on the Vedānta Sūtra, and therein developed his theory, obviously taking it from the Nyāya-darśana, where it occurs in an unmistakable form. His doctrine is known under the name of *Pūrṇaprajña-darśana*, and his followers call themselves Brahma-sampradāyī. As already stated, it dates from long before the time of the Aduā doctrine. It is frequently referred to in the Vedas, and in the Upanishads it is indicated at times. But the idea is not fully worked out, and in some places, the theory of both the Supreme and the individual souls abiding in the same body crops out prominently. This is particularly the case in a remarkable allegory in the Muṇḍaka Upanishad, which occurs also in the Svetāśvatara Upanishad, where it is said :

“Two (birds) of handsome plumage, rivals and friends, nestle in the same tree : one of them eats the sweet fruits ; the other looks on without eating.”†

The obvious meaning of this verse implies a duality ; and those who adopt the Dual theory appeal to this authority ; but Śankara looks upon it as an indication of the Supreme Soul associated with plastic nature or Prakṛiti, or “consciousness associated with ignorance, desire and the residua of former works.”‡

Closely correlated with the above theories are the doctrines of *Saguṇa* (qualified) and *Nirguṇa* (unqualified) in regard to the Supreme Soul. The nearest equivalent English philosophical terms for these would be ‘con-

\* Grammatically the word should be *Mādhva* as a derivative of *Madhu*, but in MSS. it is frequently, not always, found with the first vowel short, and both Professor Wilson and Mr. Gough (in the *Sarvadarśana-saṅgraha*) have accepted that form.

† द्वा सुपर्णा सयुजा सखाया समानं वृक्षं परिषस्वजाते ।

तयोरेक्यः पिप्पलं स्वाद्वत्फलमश्नतः । भिन्नचित्तौ ततः ॥

‡ अविद्याकामवासनाश्रयिणीपादिविज्ञानाभा ।

ditioned' and 'unconditioned,' but they are not exactly to the point. Unconditioned in English has two meanings. Some employ it to denote entire absence of all *restrictions*, while others, and a large number, take it to imply entire absence of all *relation*. Indian philosophers are unanimously of opinion that the Supreme Soul is absolutely unconditioned in the sense of total absence of all restrictions. It is perfectly free from all trammels of laws, rules and conditions, and nothing can restrict it in any sense whatever. But they are divided as regards relation. The followers of the Yoga school hold that there is no relation whatever between the Supreme Soul and the universe. The universe is uncreate and eternal, and its course is regulated by laws or nature which is not subject to Divine will, and human souls, being uncreate and eternal, are equally independent of a creator. But those monitists who believe in a primal creation and trace that creation to a divine architect, have to establish a relation between the Divine and the individual souls, and opinions in this respect vary greatly. Their diverse theories about emancipation also necessitate some relation. The doctrine of incarnation also requires that the Divinity should be, at least at times, subject to conditions. And the process of transition from the unconditioned to the conditioned has been explained in different ways. The word *saṁyama*, moreover, implies personality, and some of those who believe in incarnations insist upon the Godhead being a personal divinity, while others hold him to be always and invariably impersonal (*nirguṇa*).

To turn now to the Vaiṣṇavas. They belong to one or other of the three subdivisions of the Adual school or to the Dual one, under the generic names of Śrī-saṁpradāya, Rudra-saṁpradāya, Brahma-saṁpradāya, and Saṅkādī-saṁpradāya, and the reconciliation of their different theories to subserve the cause of Bhakti is the object of the work under notice.

The work opens with a quotation from the Bhāgavata Purāṇa in which Kṛiṣṇa says "know ye that I am the preceptor of all preceptors" (*Sarveśham aṁy āchāryāṇām āchāryaṁ mām vijānīyāt*), and then argues, since preceptors (*āchāryas*) are incarnations of the Lord, and their instructions must be evidence of truth, it follows that when Vallabha Āchārya and others, after refuting the Dual dogma, establish the Nondual one, their doctrine must be accepted as true; but in so accepting it, one must reject the theory of Mādhva as unreliable and untrue. Should he, however, accept the theory of Mādhva, the sayings of Vallabha Āchārya and others, which refute the Dual tenet, must of course fall to the ground. 'And on the logical principle of that which is contradictory is incorrect,' all the various doctrines of the Vaiṣṇavas must be condemned as untrue. The question then is, how to solve this riddle? And

the author begins by enquiring what was the doctrine of Chaitanya, the founder of the Vaishnava sect of Bengal? As I have already remarked at the beginning, this was a moot point. Chaitanya has not left us any record of his philosophical ideas. He was an enthusiastic Bhakta, who devoted his entire time to the cultivation of faith, in abstracting himself from all carnal wants and worldly attractions, in dedicating himself, body and soul, to his maker, and in disseminating the doctrine of faith among his followers. It is doubtful if he ever wrote any work or treatise on religion. Certain it is that none has come down to our time. Kavikarnapurā, a contemporary of Chaitanya and author of great eminence among the Vaishnavas, flatly denies that Chaitanya ever wrote anything about his doctrine. In the 'Chaitanya-chandrodaya' of that author the question is asked, "Dear Sir, has this Hari published any work explanatory of his principles?" and the reply given is: "Though it is well-known that the Almighty is the author of the Vedas, yet whatever the Knower of the heart teaches, he teaches through agents indirectly, and his lessons are not defined by time or space."\*

His biographers devoted themselves with Boswellian assiduity to the task of recording his sayings and doings, and certainly succeeded in preserving a vivid picture of his life. But their object was to appeal to the masses, to create a lively interest in their teacher, and anecdotes of benevolence, mercy, devotion, self-abnegation, and total disregard of worldly attractions, were calculated to serve their purpose best, and they selected them. Philosophical dogmas and abstruse reasoning about the Unconditioned were the least adapted to subserve such a purpose, and they therefore eschewed them altogether, or kept them in the back ground. And under the circumstances it is but natural that there should be considerable difference of opinion in regard to the saint's system of philosophy. The thesis has to be worked out by a comparison of the bearings of his casual remarks and mode of life, and not proved by the quotation of any positive declaration. Our author starts by saying that Chaitanya inculcated the same doctrine of Dualistic Aduality, which Nimbāditya had taught long before him; and in support of his position combats such objections as, in his opinion, might be started against it.

To the faithful followers of Chaitanya the first objection would naturally be, how can Chaitanya, who was the Supreme Divinity, even Vishṇu himself, born in flesh, accept the doctrine of a mere mortal, and become his follower? He should teach that which is original, that which none before

\* पारिपाश्चदः । भाव किं तेनेह तेने हरिणा स्वाभिमतमतव्यञ्जको ग्रन्थः ।

स्य चारः । यद्यपि को न वेद वेदकर्मत्वं भगवत्स्य यपि स्वत्वमर्थामी यामीहते प्रेरणा न चक्षु सा वाङ्मोक्षदेशतो देशतो वा कालतश्च परिच्छिन्ना भवितुमर्हति ।



knew, and not that which was already known. The objection is met by the remark that Nimbāditya was an incarnation of Viṣṇu, and his opinion was therefore that of Viṣṇu, and Chaitanya being, likewise, an incarnation of Viṣṇu, the doctrine expounded is of the same individual given under different conditions, and there is therefore no following in the case. In order to prove that Nimbāditya was an incarnation of Viṣṇu, a verse is cited on the authority of Hemādri, who makes the statement. Learned Vaishṇavas, moreover, urge that the primary object of Chaitanya was not to inculcate a new tenet in psychology, but to give wide currency to the doctrine of Bhakti, and it was not necessary for him, therefore, to dwell upon universally accepted truths.

Having answered this preliminary objection, the author cites in support of his opinion that Chaitanya was a Dvaitādvaitavādī, several authorities. The first is Viśvanātha Chakravartī who, in his commentary on the Bhāgavata, it is said, has made the statement. The words used are, *Chakravartibhiḥ svagranthe nimbāditya-mata-vartitvena mahāprabhūnāṃ likhant,* but no quotation is supplied.

The next authority is Gaṅgārāma Gauḍa, who is said to have been a disciple of Chaitanya. In his case, however, there is a specific assertion. In his work called *Nibandha* he begins with the remark that "Nimbāditya was the destroyer of darkness" (*Nimbādityas tamolhvaṃś*) and ends by saying "composed by a follower of the doctrine of Nimbāditya," (*Nimbāditya-mata-vartī-virachitāyām*), and the inference from these passages is that since an immediate disciple of Chaitanya professed himself to be a follower of Nimbāditya's doctrine, his teacher must have followed the same doctrine.

The third authority is Harideva Tarkavāgīśa, of Saidābād, near Murshidābād, but no passage has been cited, nor is the name of his work given. I have not heard of this personage, and no one can give me any information about him:

The last authority is Nārāyaṇadāsa, a disciple of a disciple (*anūśiṣhya*) of 'Advaita Aśhārya, and a Vaishṇava author of some repute. In his treatise on branding the body with the symbols of Viṣṇu, (*Tāptamudrā-dhāraṇa*) he makes a positive statement to the effect that Chaitanya accepted the Dualistic Aduality doctrine of Nimbāditya.

It is scarcely necessary to observe that this collection of authorities is poor at best, and such as it is, it may be easily set aside, both by circumstantial evidence and by positive statements of the contemporaries of Chaitanya. Bhaktas believe 'that in order to the attainment of supreme beatitude, they must pass through five stages or states of probation. The first of these is called *Sānta* or quietism, or a state of calm contemplation of the Deity. The second is *Dāśya* or servitude, which in a more

active state leads on to the third, or *Sākhya*, i. e., an ardent feeling of friendship for the divinity, and that in its turn to the fourth or *Vātsalya* (filial affection), and lastly to *Mādhurya* or love, when the devotee, rising above all idea of divinity, entertains the same ardent attachment for the Deity which a human lover feels for the object of his love, or "what the milkmaids of Vṛindāvana entertained for their charming Kṛishṇa." These ideas cannot be consistent with the theory of Aduality. Service and friendship cannot exist where the adorer and the adored are identically the same. One must start with the idea of inferiority before he can deem worship and service desirable or appropriate, and this would necessarily imply Duality and not Unity. Nor is the reward of the service, &c., as inculcated by the Vaishnavas, such as to support the Adual theory. That reward, according to the Bhāgavata Purāṇa is fivefold; \* it may amount to (1) dwelling in the same region with the Divinity, (*sālokyā*), or (2) to the attainment of the same supremacy or dominion as that of the Divinity (*sārshṭi*), or (3) to fellow-lodgership, or living in close proximity to Him (*sāṁīpyā*), or (4) to the attainment of the form of the Divinity (*sārūpyā*), or (5) to unity or union with Him, (*ekatva*).† The last is the same with the Nirvāṇa or *Laya* of non-Vaishṇava authors, but Vaishṇava commentators are not satisfied with it, and explain it away in various ways. The word *sāyujya* is a homonym of *ekatva*, and that has been explained by Tārānātha in his *Vāchaspatya* to mean dwelling together (*ekutra-samavasthāna*); others hold it to mean communion or practically entering a house, but not being identified with it.‡ Any how the Vaishnavas do not care for the last, and rely on the first four, and therein, we have rivalry, independent existence &c., but no union or merging of the human into the Divine Soul, and consequently a dual theory. Kavikarṇapura, who was a contemporary of Chaitanya, and took pride in having seen the saint during his ministry, and for having followed him as a disciple, is clearly of opinion that Chaitanya

\* सांख्येय-सार्ष्टि-सामीप्य-सारूप्यकलमयुत । Book III, Chapter 29, Verse 13.

† Śrīdhara Svāmī explains these five terms thus : सांख्येयं मया सच्च एकस्मिन् लोके वासः । सार्ष्टि समानैश्वर्यं । सामीप्यं निकटवर्त्तित्वं । सारूप्यं समानरूपता । एकत्वं सायुज्यं ।

‡ कस्मिन्नपि पुस्तके श्लोकमध्ये सायुज्यपाठः व्याख्यादृष्टामसम्मतः । किन्त्वेकत्वमित्यस्य व्याख्यानं सायुज्यं । यदि च सायुज्यपाठः केनापि स्वीकृतोक्ति तदा सायुज्यैकत्वयोः को भेदः स्यात् । अत्र समाधानं । सायुज्यशब्दस्य प्रवेशार्थेनेपि परमेश्वरात्मकत्वं न स्वीकार्यं, तथा-पुनरं प्रविशन्तीत्यत्र पुरस्संयोग एव प्रतीयते न तु पुरात्मकत्वमिति । एतदप्या व्याख्या कस्मिन्-चित् स्थाने प्राचीनैः कृतास्ति ॥

was a Dvaitavādi, and in the work above named thus expresses his convictions :

“ACTOR.—Your Bhaktiyoga or exercise of devotion, which, you say, was unknown to the authors of our Śāstras, produces a wonderful knowledge the result of which is absorption into the Deity, the same which the professors of the Śāstras inculcate ; where lies then the difference ?

“MANAGER.—From the text which says :—‘The recitation of the name of the loved one produces an enamoration and an earnestness which makes him, who adopts the religion, to laugh, and cry, and scream, and sing, and dance like a mad man,’ it is evident that the Bhaktiyoga, of which singing the name of the Lord is a component, produces a peculiar attachment which passes on to an excessive fellow-feeling. It is also said, ‘such truthful beings perceive me to be of pleasing and of benignly smiling—of gratifying and excessively beautiful—forms, with rosy eyes, and talk to me in sweet soothing words. Devotion by the aid of those charming forms and innocently playful and smiling glances and pleasing speech, robs them of their mind and soul, and leads them on unto salvation, against their will.’ From which you see that salvation is a state of fellow-ship with the Deity and not absorption ; therefore the venerable Kapila said : ‘devotion is superior to santification ;’ and hence is the singing of the name of the Lord, in the Kaliyoga, no secondary means towards the attainment of the great object of human existence, and the source of heavenly love.

“ACTOR.—Sir, your words are most wonderful. The Śāstras ordain that the name of the Lord leads to absorption, and you maintain the contrary. We have heard, ‘by reciting the name of Nārāyaṇa the dying Ajāmila obtained *mukti*.’

MANAGER (*smiling*).—The word *mukti* here means fellowship, for in that very place it is said : ‘He immediately assumed the shape of the companions of the Deity.’ The doctrine of Kṛishṇa Chaitanya overthrows all others. All righteous men adopt this doctrine. Even Kali himself is blessed by this incarnation.\*

It should be added, however, that Kavikarṇapura has approvingly quoted many passages from the Pancharātras and other works which are strongly adualistic in their purport, and makes Chaitanya say that he entirely subscribed to them. The only way to reconcile this contradiction is to accept the theory of Dualistic Aduality, which after all is but a compromise, and as such affords room for the simultaneous inculcation of the two dogmas. The fact is, Chaitanya never busied himself with pure psychology, and the attribution to him of any specific doctrine is more a matter of convenience than a positive historical fact.

\* R. Mitra’s Chaitanya-chandrodaya, Introduction, pp. xi-xii.

To resume our analysis of the work under notice. The objection which next suggests itself to our author is—since Mādhva, Rāmānuja and Viṣṇu Svāmī have been recognized as teachers and great Vaiṣṇavas, how can their opinion be rejected? But this is evaded by the remark that their tenets have not been completely developed in their works.

Next comes S'ṛīdhara Svāmī, a renowned exegetist on the Bhāgavata, in regard to whom Chaitanya himself had said—"What is opposed to the tenets of Svāmī should be spurned by us" [*Svāminata-viruddham yat tad asmākam anādararīyam.*] He upholds the doctrine of Suddhādvaita, and how is that to be reconciled with the assumption of Chaitanya having followed Nimbāditya? This is met by a reference to the Sandarbhas,\* where it is argued that in his commentary on the Bhāgavata, S'ṛīdhara Svāmī has devoted very little space to the explanation of the doctrine of knowledge combined with faith (*jñānamīśra-bhakti*), whereas he has dwelt largely on pure faith, (*śuddha-bhakti*), and it is obvious therefore that he preferred the latter. According to the Advaita system, God is always and invariably unconditioned, and never becomes conditioned, but in the Bhāgavata Purāṇa his incarnation is repeatedly admitted, and S'ṛīdhara Svāmī having admitted that, it must also follow that he did not entertain the pure Aduā doctrine, and *ex necessitate rei* must have accepted the theory of Dualistic Aduā.

The last position opens the way to the question, why not then at once admit the Dualistic theory which is more favourable to the incarnation dogma than the other? If we believe human souls to be emanations of the Divine one, every birth would be an incarnation of the Divinity, and there would be no difference between ordinary births and incarnations, except, perhaps, in the quantity of the divine essence contained in each, and we have to divide the unconditioned into quantities of greater and less proportions, whereas the Dual theory marks a radical difference of essence, and thereby obviates every difficulty. It is appropriate, too, that the inferior should evince faith and devotion to the superior, but where there is no difference in essence, it is inconsistent to talk of faith and devotion. And inasmuch as Chaitanya laid the greatest stress on incarnations

\* Six different works on the religion of Chaitanya bearing the common appellation of *Ṣaṭ-sandarbhā*. Their specific names are—(I) *Bhakti-sandarbhā*, (II) *Tattva-saṅdarbhā*, (III), *Bhagavat-sandarbhā*, (IV), *Paramārtha-sandarbhā*, (V) *Kṛishṇa-sandarbhā*, (VI) *Prīti-sandarbhā*. There is a 7th under the name of *Daśamākrama-sandarbhā*, which is looked upon as an appendix to the hexapartite work. These were written by Jīva Gośvāmī under the superintendence and instruction of Rūpa and Sanātana, the two foremost disciples of Chaitanya. The object of the works is to prove that the doctrine inculcated in the Bhāgavata is the same which Chaitanya taught.

and on the doctrine of Bhakti some person assume that he followed the doctrine of Mādhva A'chārya. This is, however, not admitted, inasmuch as Chaitanya has himself said (as recorded by Kṛishṇadāsa Kavirāja, in the second book of the Charitāmṛita) that the distinctions of the adorer and the adored is inconsistent with pure faith.\*

He goes further and says, "the two theories of the identity of the Divine and the individual soul, (*abheda*) and of the radical difference thereof (*bheda*) have been inculcated by Viṣṇu Svāmī and others ; among them those who hold the identity doctrine should be known as following the opinion of Viṣṇu Svāmī, and those who adopt the radically different one follow the opinion of Mādhva, and therefore they are called *tāmasak* or appertaining the quality of darkness.\*†

This would have sufficed for an argument ; but as the object of the writer is to reconcile all adverse opinions, and not to create dissensions, he goes on to say that, though apparently contradictory, the opinion of Mādhva is not hostile, and he works out this idea by saying that Sankara and others were great devotees or worshippers of Bhagavān (Viṣṇu), and as such they could not be otherwise than following the doctrine of Nimbāditya who gave the greatest emphasis to faith, and Mādhva A'chārya, being an immediate disciple of Sankara A'chārya, he and his later followers cannot have forsaken the doctrine of their philosophic tutor, and we are informed in the Sandarbhas, that by following the teachership of Mādhva, Chaitanya could not but continue to belong to the school of Nimbāditya.‡ He then anticipates the objection—what proof have we that the teachership of Sankara and Mādhva was admitted, and urges in reply that the Sandarbhas say so. Passages are also cited from the *Padma Purāṇa*, the *Agni Purāṇa* and Sankara's commentary on the *Viṣṇu-sahasra-nāma* to prove this theory. It is argued, further, that even as Sṛīdhara Svāmī, so has Sankara, in his work dwelt on both the doctrines of Duality and Aduality, and his instructions differ only with reference to the mental character of his pupils, as householders or hermits, and the

\* यत्तु भक्तेः साधनं साध्यं च प्रतिपादितं तत् शुद्धभक्तेः । विषयमचेति श्रीकृष्णचैतन्यचरितामृते मध्यमखण्डे श्रीमहाप्रभुभिः कथितमिति ।

† विष्णुस्वामिभिर्भेदाभेदै प्रतिपादितौ तन्मध्ये अभेदांशे विष्णुस्वामिमतानुसरणं भेदोपि तैर्माध्वमतवत् प्रतिपादितं तदर्थं ते तामसा इत्युक्तं ।

‡ किञ्च माध्वमतवर्तिलस्याभ्युपगमेऽपि न विरोधः । तथा हि शङ्कराचार्याणां भागवतत्वेन निम्बादित्यमतवर्तित्वात् । माध्वाचार्याणाञ्च साक्षात् तत्स्थितताप्राप्तेरिति तच्च--वादिगुरुणामाधुनिकानां श्रीशङ्कराचार्यश्रिष्यतां स्वध्यापयत्यनेन च सन्दर्भः । तत्स्थितप्रतिपादनेन तत्स्थितभूतमाध्वमतवर्तिलश्रिष्याणां महाप्रभूणां माध्वमतवर्तिलेऽपि निम्बादित्यमतवर्तिलम् ।

difference therefore is not essential. In support of this, a verse is paraphrased from the Gítá which says, "Each beholds God in the same way in which he reflects on Him," (*yádriśi bhāvanā yasya tādṛig eva tasya svarūpaṃ darśanam*).

In the course of his work the author enters frequently into the question as to how the Unconditioned Divine Soul, formless, qualityless, and all-pervading, makes itself conditioned in incarnations? As a devout Vaishnava, believing with all his faith Chaitanya to be the sum total of Divinity in a human form, he cannot deny that God descends on earth in human flesh, and yet, he cannot raise his voice against the great teacher of his faith who has upheld the nondual doctrine, and he gets out of the difficulty by saying, "Verily Brahma is of the form of truth, intelligence and joy, but to extend his grace to his devotees he appears in substantial forms",\* and fortifies his position by a number of quotations. The dogma is of course as old as that of incarnation, and needs no amplification here. Nor need I say anything on the logical consistency of the arguments by which the various reconciliations are effected. The work is intended for men of devout faith, and logic in their case is often quite different from what it is to ordinary common sense.

\* सविदानन्दरूपं ब्रह्मैव भक्तानुग्रहाय विभूतविपदस्वरूपं ।

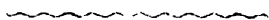




Fig. 1. Mandala.

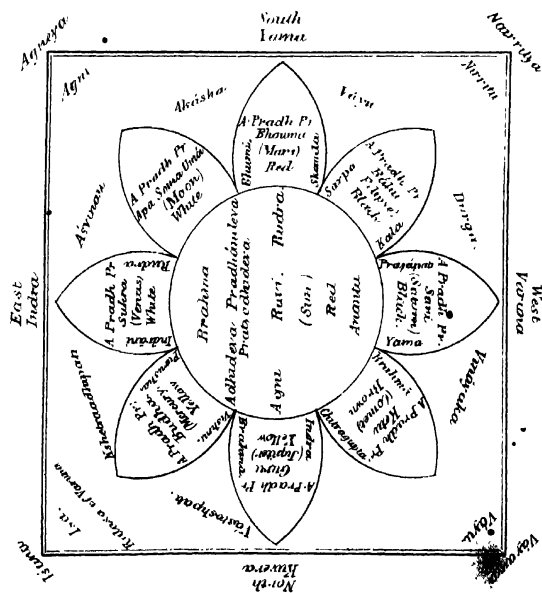
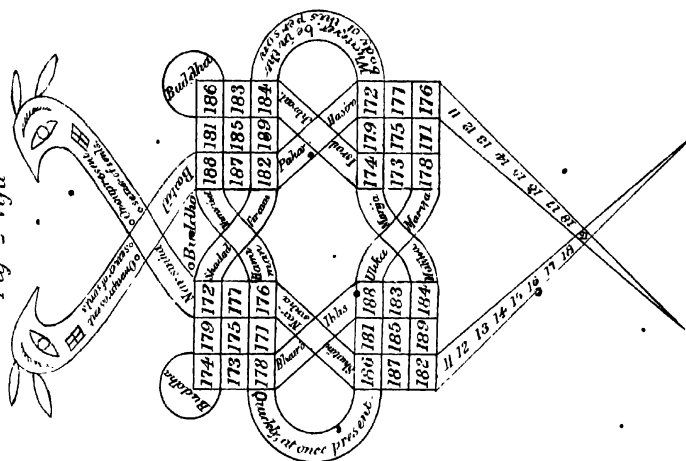


Fig. 2. Vija







# JOURNAL

OF THE

## ASIATIC SOCIETY OF BENGAL,

Part I.—HISTORY, LITERATURE, &c.

No. II.—1884.

*A Classified and Detailed Catalogue of the Gold Coins of the Imperial Gupta Dynasty of Northern India, with an Introductory Essay.—*  
By V. A. SMITH, B. A. Dubl., B. C. S.

(With 4 Plates and a Table of Weights.)

INTRODUCTORY ESSAY.

Section I.—Preliminary.

The imperial Gupta dynasty is known to have consisted of a lineal succession from father to son of seven sovereigns, not including Budha Gupta, a local ruler in the country between the Jamuná and the Narmadá, nor various other princes who retained a grasp on the eastern portions of the Gupta empire, after the decadence of the imperial family.

No coins are known to exist which can be referred with certainty to the founder of the dynasty, who is in the inscriptions simply named Śrī Gupta.\* Ghaṭot Kacha, Chandra Gupta I, and Samudra Gupta who

\* A gold coin found in Jessore was formerly attributed to Śrī Gupta, (*J. A. S. B. XXI, p. 401; Pl. XII, 10*), but this attribution cannot be maintained. The unique silver coin, belonging to Mrs. Freeling, which was at one time believed to belong to the reign of Śrī Gupta, is plainly a coin of Skanda Gupta (*Records of the Gupta Dynasty, pp. 49, 50*). General Cunningham, nevertheless, still assigns to Śrī Gupta an unpublished coin in his cabinet. In the case of this prince the word Śrī would seem to be an integral part of his name, for the past participle 'Gupta' can hardly stand alone. Śrī Gupta would therefore mean 'protected by Śrī' or Lakshmi. In the names of the succeeding princes the word 'Śrī' is used only as the customary honorific prefix, which is, in my opinion, best left untranslated. I-tsing speaks of the king who preceded his time by 500 years as 'Śrī Gupta,' not simply as 'Gupta' (*J. R. A. S. Vol. XIII, N. S. p. 571.*)

were respectively the second, third, and fourth sovereigns of the line, appear to have coined in gold only, and gold pieces of all these princes are extant. It is probable that during their reigns, as in the time of their Indo-Scythian predecessors, the silver currency was supplied "by the abundant issues of the Greek princes."\*

The fifth king, Chandra Gupta II, has left coins in gold, silver, and copper, as also has his son and successor Kumára Gupta Mahendra.

Skanda Gupta, the last of his line who enjoyed imperial power,† did not, as far as is at present known, issue any copper coinage, but specimens both of his gold and silver mintages exist in considerable numbers.

Budha Gupta's money is known in silver only; and the coins of Nára Gupta and other eastern successors of the imperial dynasty occur only in gold, though the metal is often very impure.

The design of my catalogue is limited to a description of the coins of the imperial Guptas, as above defined, but, inasmuch as earlier publications on the subject do not discriminate the local and imperial coinages, I have been compelled to notice briefly in a Supplement some of the coins of Nára Gupta and other minor kings of uncertain date and lineage. The full discussion of these later coins would require a long dissertation to itself. For various reasons I shall not attempt to discuss the silver coinages of the Gupta kings, although there is still room for a comprehensive essay on the subject.‡

The rare copper coins of Chandra Gupta II and Kumára Gupta Mahendra seem to possess comparatively little historical interest, and, except as curiosities, are certainly of less importance than the gold and silver coins. I therefore pass them by for the present, without detailed notice. It is probable, as suggested by Wilson, that the vast Indo-Scythian issues of copper coin supplied the Gupta era with nearly suffi-

\* *Ariana Antiqua*, p. 348.

† On another occasion I may perhaps venture on a review of what is known of Gupta history and chronology, but there is reason to hope that the task may be undertaken by a more competent hand. For the present it will suffice to say that I consider the death of Skanda Gupta, or, at least, the break up of his empire, to have occurred in A. D. 318-319, and both the reign of Śrī Gupta and the Gupta era to have begun about 160-170 A. D. I altogether dissent from the view of Prof. Oldenberg and other writers who make the Gupta dynasty begin in A. D. 318-9; and I am equally unable to agree with Mr. Thomas in identifying the Gupta and Śaka eras.

‡ This remark must not be understood as signifying any failure to appreciate the value of Mr. Thomas' and General Cunningham's writings.

cient currency in that metal;\* and, as in modern times, a large proportion of the small change required may have consisted of cowries, and of tokens issued by private persons.

The gold coinage of the Gupta kings is, on many grounds, of exceptional interest. The great variety of type is remarkable, and suggests many problems in the history of art, religion, and nations. Though some of the types are common, others are of extreme rarity, and to be reckoned among the most desirable treasures of the Oriental numismatist. The proper attribution of several of the types is doubtful, and supplies a thème for abundant discussion, and for the exercise of numismatic acumen. The execution of many of the coins is of a comparatively high order of art, and the design is not unworthy of the execution; while, in most of the types, both design and execution have such strongly marked national characteristics that they are far more interesting than the mere imitations of foreign work which are found in the majority of Indian coinages. Foreign ideas are clearly traceable in this series of coins, but they are, in the best types, skilfully assimilated and Hinduized.

The Hindú character of nearly all the Gupta gold coins is a plainly

\* General Cunningham informs me that, so far as he knows, only one copper coin of Kumára Gupta has yet been found. It has not been published. Sir E. C. Bayley (*Num. Chron. for 1862 p. 158*) mentions the Gupta copper coins as being "among the rarest of all Indian coins," and expresses a belief that they "seldom occur except in the immediate neighbourhood of the Gupta capital, Kanauj" [*sic*].

Copper coins, as Prof. Gardner has observed (*Catal. of Seleucid Coins, p. xxvii*), are very seldom dug up far from their place of mintage, and, therefore, if Sir E. C. Bayley's belief as to the *provenance* of the Gupta copper pieces is correct, the common opinion that Kanauj was the Gupta capital would receive some support. But, the evidence, so far as it goes, indicates that the copper coins, like those in gold, were coined further east. Prinsep describes six specimens, and of these three were from the cabinet of Mr. Tregear, who collected at Jaunpur. The other three were respectively in the Stacy, Swiney, and Prinsep collections, and it is not said that any of them came from Kanauj. I have not any further information as to the find-spots of the Gupta copper coins. Sir E. C. Bayley in the passage above quoted rather exaggerates the rarity of the copper issues of Chandra Gupta II. Ten specimens are in the British Museum, and one is in the India Office collection. The cabinet of the Asiatic Society of Bengal contains "many" similar to fig. 15 in Pl. XXX of Prinsep's Essays, one like fig. 12 of the same plate, and one of the 'vase' type as figured in J. A. S. B. XXXIV, Pl. V. figs. 20, 21. General Cunningham and Mr. Grant possess specimens, and Mr. Thoobald has a large coin, a duplicate of Prinsep's fig. 11, the obverse of which presents the king shaded by an umbrella. Further specimens doubtless exist in the cabinets of other collectors. See Prinsep's Essays, Vol. I, pp. 374-375, and Pl. XXX, figs. 11-15; Ariana Antiqua, Pl. XVIII, fig. 15 (the same as Prinsep's fig. 14); and J. A. S. B. Vol. XXXIV (1868) p. 125, and Pl. V. figs. 20 and 21.

legible record of a native reaction directed by the Gupta kings against the domination of the foreign Scythian ideas.\*

The numerous, and frequently well preserved, legends on the coins of the Gupta dynasty offer much interesting material for the study of the historian and palæographer.

In addition to all the above reasons which render attractive the study of the Gupta gold coinage, another is furnished by the chaotic state of the literature on the subject and the incompleteness of the existing catalogues, which loudly call for re-arrangement and revision.

The difficulty experienced by myself in studying the coins with the help of existing publications first induced me to make an attempt to summarize and systematise the known facts. The work has grown under my hands, and, imperfect as it is in many respects, I trust that the labour bestowed upon it may not have been altogether thrown away.

"No trouble," says Dr. Burnell, "is thrown away, which saves trouble to others,"† and, even if I have failed to solve any of the numerous historical and numismatic problems suggested by the study of these coins, I can scarcely have failed in smoothing the path for investigators more fully equipped with the needful learning and technical experience. I have been encouraged in my undertaking by the recently expressed opinion of General Cunningham that "the gold coins of the Guptas require to be carefully re-examined."‡

So far as my opportunities permitted I have made a careful examination of this series of coins, and now submit the results of the investigation and the opinions I have formed to the candid criticism of all competent judges in the hope that they will supplement my facts where they are incomplete, and correct my opinions where they are erroneous.

I have endeavoured to work in the spirit of the words of Saint-Hilaire :—"La Numismatique est patiente, et elle amasse les faits spéciaux qui la concernent, jusqu'à ce que l'histoire vienne plus tard en donner la véritable clef, si jamais elle le peut."§

### *Section II.—Types and Devices.*

In Mr. Thomas' valuable catalogues|| the several types and varieties are distinguished by an arbitrary alphabetical notation, for example,

\* In the N. W. P. Gazetteer for Basti (*Vol. VI, p. 718*) the rise of the Gupta dynasty is absurdly described as a triumph of Buddhism over Hinduism. Śrī Gupta may have been a Buddhist possibly, but certainly his successors were all Hindūs.

† Quoted in Max Müller's 'India, What can it Teach Us,' p. vii.

‡ Proc. A. S. B. August 1882, p. 113.

§ Journal des Savants for 1865, p. 413.

|| J. A. S. B. XXIV, pp. 487-502; and Prinsep's Essays, Vol. I, pp. 377-387.

E, E b, 2 E b. Such a notation is confusing and gives little assistance to the memory. I have ventured on a novel nomenclature which will, it is hoped, prove appropriate and convenient.\* The devices, both obverse and reverse, of the Gupta gold coins display a remarkable amount of variety in conception and execution, and thus afford ample facilities for classification. The obverse devices, when regarded with reference to the most prominent or characteristic feature in each, are readily divisible into 19 classes, of which few are common to two or more reigns. The reverse devices, when classified in a similar way, fall into but 9 classes, and are far less characteristic of the several reigns. It is evident, therefore, that the classification of types should be based, as it is in Mr. Thomas's catalogues, on the obverse devices. The main types are named and classified in my catalogue as follows, the name of each type being intended to indicate the most conspicuous, or most characteristic element in the obverse device. The definition of each type will be found in the Catalogue.

| <i>Reign.</i>         | <i>Type.</i>                                               |
|-----------------------|------------------------------------------------------------|
| I. Ghaṭot Kacha.      | 1. Solar Standard. ( <i>Pl. II</i> ; 1).                   |
| II. Chandra Gupta I.  | 1. King and Queen. ( <i>Pl. II</i> ; 2).                   |
| III. Samudra Gupta.   | 1. Javelin. ( <i>Pl. II</i> ; 3, 4, 5).                    |
|                       | 2. Archer. ( <i>Pl. II</i> ; 6).                           |
|                       | 3. Lyrist. ( <i>Pl. II</i> ; 7, 8).                        |
|                       | 4. Aśwamedha. ( <i>Pl. II</i> ; 9).                        |
|                       | 5. Tiger. ( <i>Pl. II</i> ; 10).                           |
|                       | 6. Boy and Battle-axe. ( <i>Pl. II</i> ; 11, 12).          |
| IV. Chandra Gupta II. | 1. Couch. ( <i>Pl. II</i> ; 13).                           |
|                       | 2. Archer. ( <i>Pl. II</i> ; 14: <i>Pl. II</i> ; 1, 2, 3). |
|                       | 3. Lancer. ( <i>Pl. III</i> ; 4).                          |
|                       | 4. Horseman to Left. ( <i>not figured</i> ).               |
|                       | 5. Lion-Trampler. <i>Pl. III</i> ; 5).                     |
|                       | 6. Combatant Lion. ( <i>Pl. III</i> ; 6).                  |
|                       | 7. Retreating Lion. ( <i>Pl. III</i> ; 7).                 |
|                       | 8. Swordsman and Umbrella. ( <i>Pl. III</i> ; 8).          |

\* The term 'archer coins' has already been used by Wilson. (*Vishṇu Pur.* p. 480, note 70.)

- V. Kumára Gupta Mahend:
1. Swordsman. (*Pl. III*; 9).
  2. Archer. (*Pl. III*; 10, 11).
  3. Horseman to Right. (*Pl. III*; 12).
  4. Horseman to Left. (*Pl. III*; 13).
  5. Peacock. (*Pl. IV*; 1, 2).
  6. Lion-Trampler. (*not figured*).
  7. Combatant Lion. (*Pl. IV*; 3).
  8. Two Queens. (*not figured*).
- VI. Skanda Gupta.
1. Archer. (*Pl. IV*; 4).
  2. King and Queen. (*Pl. IV*; 5).
- VII. Doubtful (Chandra etc.)
1. Archer. (*Pl. IV*; 7-10).
  2. Lion and Horseman. (*Pl. IV*; 11, 12).
- " " (Prakásáditya.

I have not found it practicable to classify the subordinate varieties on any definite principle, and they are arranged as seemed convenient in each case.

The 9 classes of reverse devices all agree in presenting as their main element the figure of a female, associated with emblems which prove that she is intended to represent a divine personage.

These reverse devices may be classified as follows:—

| <i>Device.</i>                                                     | <i>Reverse</i>   | <i>Obverse</i>    |
|--------------------------------------------------------------------|------------------|-------------------|
| I. a. Standing goddess holding lotus-flower and cornucopia.        | Ghatot Kacha     | Chandra Gupta I   |
| " β. Ditto, holding fillet and lotus-flower, or fillet only.       | Chandra Gupta II | Swordsman & " " " |
| II. Goddess standing on dragon, holding standard and lotus-flower. | Samudra Gupta.   | Tiger.            |
| III. Female (? goddess) standing, with fly-whisk                   |                  | Chandra Gupta II  |

|       |                                                                                                 |                                                                                                                            |                                                                                                              |
|-------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| IV.   | Goddess seated on fourlegged throne, holding fillet and cornucopia, or fillet and lotus-flower. | Chandra Gupta II.                                                                                                          | Javelin.<br>Archer.<br>Coneh.<br>Archer.                                                                     |
| V.    | Goddess seated cross-legged on open lotus-flower, generally holding fillet and lotus-flower.    | Chandra Gupta II.<br>Kumára Gupta Mahendra.<br>" "<br>" "<br>Skanda Gupta.<br>" "<br>Doubtful (all)<br>" (? Prakásaditya.) | Archer.<br>Swordsman.<br>Archer.<br>Two Queens.<br>Archer.<br>King & Queen.<br>Archer.<br>Lion and Horseman. |
| VI.   | Goddess, seated on wicker stool to left;                                                        |                                                                                                                            |                                                                                                              |
| " a.  | holding fillet and cornucopia.                                                                  | Samudra Gupta.                                                                                                             | Lyrist.                                                                                                      |
| " β.  | holding fillet and lotus, or fillet and sceptre, or lotus only.                                 | Chandra Gupta II.<br>" " "<br>Kumára Gupta Mahendra.                                                                       | Lancer.<br>Horseman to Left.<br>Horseman to Right.                                                           |
| " γ.  | feeding peacock and holding lotus.                                                              | " " "<br>" " "                                                                                                             | " " "<br>" " Left.                                                                                           |
| VII.  | Goddess riding peacock.                                                                         | " " "                                                                                                                      | Peacock.                                                                                                     |
| VIII. | Goddess standing, feeding peacock.                                                              | " " "                                                                                                                      | Combatant Lion.                                                                                              |



|                                                                          |                        |                      |
|--------------------------------------------------------------------------|------------------------|----------------------|
| IX. Goddess seated on {<br>back of couchant<br>lion ;                    |                        |                      |
| „ a. holding fillet and<br>cornucopia.                                   | Chandra Gupta I.       | King & Queen.        |
| „ β. holding fillet and<br>lotus, or fillet {<br>only, or lotus<br>only. | Chandra Gupta II.      | Lion-Trampler.       |
|                                                                          | „ „ „                  | Combatant Li-<br>on. |
|                                                                          | „ „ „                  | Retreating „         |
|                                                                          | Kumára Gupta Mahendra. | Lion-Trampler.       |

Prinsep quickly perceived that the ‘Kanauj series,’ as he called the Gupta gold coinage, was a continuation, and, to some extent, an imitation of the Indo-Scythian mintages; and the intimate relation between the two series of coins is well exhibited in Plate XXXVI of Vol. V of the *Journal of the Asiatic Society of Bengal* (*Pl. XXIX of Prinsep’s Essays; ed. Thomas*).

The same relation is more amply demonstrated by the series of plates in the *Ariana Antiqua*, and Wilson was rightly convinced (*p. 418*) that “the coins of the Gupta princes succeeded immediately to those of the Mithraic princes.” The fact of such *immediate* succession appears to my mind indisputable, and is in itself fatal to the theories of those authors who seek to date the imperial Gupta dynasty in the fourth and fifth centuries A. D. I am convinced that to a certain extent the Indo-Scythian and the Gupta gold coinages were actually contemporary.

The standing king, engaged in sacrificing at a small altar, who appears on the obverse of the coins of Ghatot Kacha, is almost an exact copy of the corresponding figure on many coins of Kanerki and other Indo-Scythian princes.

The altar appears again in the Javelin coins of Samudra Gupta, in the β variety of the Archer type of the same prince, and in the Swordsman and Umbrella type, which I attribute to Chandra Gupta II; and it is seen for the last time in the unique Swordsman coin of Kumára Gupta. The supposition has been hazarded that the object referred to is a vessel containing the sacred *Tulsi* plant (*Ocimum sanctum*), and not an altar, but comparison with the Indo-Scythian coins proves certainly that it is the latter. Moreover, in at least one specimen in the British Museum collection, the grains of incense falling on the fire-altar are plainly indicated.

The coins of Ghaṭot Kacha possess no distinctive Hindú characteristics. The king, who sacrifices at a fire-altar, grasps a peculiar rose-headed standard, which seems obviously intended to symbolize the rayed sun. The Sun and Fire are in mythology almost convertible terms, and I think it may fairly be assumed on the evidence of the coins, that Ghaṭot Kacha (though he may have been a Hindú) was a worshipper of the solar fire, as his Indo-Scythian predecessors undoubtedly were. I am also disposed to believe that in most of the types of the Gupta gold coins the figure of the king on the obverse is intended to represent him idealized as a god, and that in the case of Ghaṭot Kacha, he is represented in the character of the solar god, shedding beneficent influences upon his subjects.

The standing goddess on the reverse bears a lotus-flower and cornucopia. The lotus-flower is an emblem very commonly used in Hindú mythology, but is especially appropriate to the Sun\* and to Śrī or Lakshmi, the goddess of good fortune.† The Sun (Súrya) may himself be regarded as a form or manifestation of Vishṇu the Preserver, the lord of Lakshmi. The cornucopia undoubtedly indicates Western influence, but whether the design was borrowed directly from Greek, or Roman, or Syrian coins, it is not easy to decide. Cornucopie occur on the coins of the Seleucid dynasty of Syria‡, but it is perhaps most probable that the device was borrowed directly from Roman *aurei*. In the Gupta series the cornucopia appears for the last time in the rare coins forming Class I of the Archer type of Chandra Gupta II, which were probably struck early in his reign. It is perhaps possible that a close comparison between the forms of the Roman and the Gupta cornucopia might help in settling the great question of the Gupta dates.§ According to the chronology which I adopt, the last appearance of the cornucopia on the Gupta coins is to be dated about 240 A. D. I regard the standing goddess on the reverse of the coins of Ghaṭot Kacha as the equivalent of the Greek and Seleucid *τύχη*, and of the Roman *Fortuna*, and believe her to be a copy, in part, of the *Fortuna Augusti* and similar figures on Roman coins, and, in part, of the elemental goddesses on the reverse of the Indo-Scythian coins. If she must be given a Hindú name, I have no doubt that she must be named Śrī or Lakshmi, the consort of Vishṇu the Preserver.

\* "The Indian mythology connected the lotus in all manner of forms with the sun." Thomas in Num. Chron. for 1880, p. 26 note. Cf. Burgess Arch. Rep. for W. India for 1874-5, p. 216 and Pl. LXV.

† Birdwood, *Industrial Arts of India*, Vol. I, p. 58.

‡ Gardner's *Catalogue of Seleucid Coins*, p. 46, Pl. XIV. Prof. Gardner informs me that Seleucid coins have been found in India.

§ See Thomas, *Early Faith of Asoka*, in J. R. A. S. Vol. IX, N. S. pp. 212-217.

Certainly she cannot be intended for Párvatí.\* I believe that she also may be regarded as representing the consort of the idealized king on the obverse, for it is a commonplace of Indian panegyric to represent Lakshmi as the king's consort.†

The standing goddess, holding fillet and lotus-flower, or fillet only, who appears on the reverse of the Swordsman and Umbrella coins of Chandra Gupta II with the legend 'Vikramáditya', is, perhaps, as suggested by Wilson, primarily intended to represent Victory, who so frequently appears on the Graeco-Bactrian coins;‡ but she may be only a slightly varied representation of Lakshmi, and it is also possible that, at the time the coins were struck, her effigy connoted equally the ideas of Victory and of Lakshmi or Good Fortune. Different symbolic interpretations are not necessarily mutually exclusive.

I have followed Mr. Thomas in calling the object in the right hand of this personification a fillet, and, if the figure is intended for Victory, no doubt the nomenclature is correct. But, as we shall see, a similar object constantly recurs in the hand of the female deities whose effigies are displayed on the Gupta coins, and in many cases I believe it would be more proper to follow Prinsep (*Vol. I. p. 230*) in calling it a *páśa* or noose.§ For convenience I shall use throughout the term 'fillet,' but it should be interpreted with regard to the qualification now stated.

The goddess standing on what looks like a dragon or marine monster (*makara* or *jalampā*) who is shown on the unique Tiger coin of Samudra Gupta does not appear to be intended for Lakshmi. In my remarks on that coin in the catalogue I have ventured to suggest two alternative interpretations of the symbolism.

The Aśwamedha coins of Samudra Gupta were undoubtedly struck to commemorate the performance of the sacrifice of the horse, with the ceremonies which expressed the performer's claim to be the supreme power in India. These pieces agree in weight with the ordinary coins of the period, but in other respects rather resemble medals, and the conjecture is allowable that they were issued as a special type of coin for

\* Mr. Thomas, however, describes her as "a rather elegant standing figure of Párvatí, with the exotic cornucopia." (*Epoch of the Guptas*, p. 23, from *J. R. A. S. (N. S.) 1881*. The same learned writer thinks that the solar standard of Ghaṭot Kacha may signify a claim to solar descent.

† E. g. Apsar inscription of later Guptas, *l. l. 8, 16*, seqq. (*J. A. S. B. XXXV, Pt. I, pp. 232, 234*), and inscription from Nepál (*Indian Ant. for 1880*, p. 165).

‡ *Ar. Ant.*, p. 418.

§ Kittoe also uses the term 'noose' in his description of the Bharsar hoard, (*J. A. S. B. XXI, pp. 390-400*).

distribution among the Bráhmans engaged in the ritual of the sacrifice.\* I cannot guess at the exact meaning of the figure of the female with the flywhisk on the reverse, but she is certainly intended for some sacred personage. Considering the undisputed solar character of Ghaṭot Kacha's coinage it may not be irrelevant to allude to the connection which existed between the Aśwamedha ceremony and Solar worship.† It is quite possible that Samudra Gupta, though a good Hindú, may have been, as many Hindús still are, specially devoted to the worship of the sun.

The legends of the King and Queen coins of Chandra Gupta I leave no doubt that the effigies on the obverse are primarily intended for the sovereign and his consort, for we know from the lapidary inscriptions that the name of the latter was Kumári Deví, and that she belonged to the Lichchhavi family. The king is figured leaning on a spear, and this device may be intended secondarily to symbolize Kumára Deva, the god of war, and husband of the goddess Kumári Deví. The reverse goddess seated on a couchant lion is probably Dúrgá, another form of Kumári Deví, but the cornucopia in her left arm indicates that the deity is presented under her beneficent, as well as her terrific aspect.

The device of the king and queen standing facing each other reappears in the coinage of Skanda Gupta, but in a much modified, and thoroughly Hinduised form. It has not yet been met with in the issues of any of the intermediate reigns. The unique coin of Kumára Gupta lately discovered by Mr. H. R. Carnac (*Proc. A. S. B. Nov. 1883. p. 144*), presents the king standing between two females, whom I suppose to be his queens.

The Javelin type is the commonest form of Samudra Gupta's coinage. The device of the obverse is but a slight modification of the ordinary Indo-Scythian pattern, and the throned goddess on the reverse is as obviously a copy of the figure called *Αρδοκπο* or *Αρδοχο* on the Indo-Scythian coins of Kanerki and his successors.

Mr. Thomas argues that this throned goddess should be identified with Párvatí, the consort of Siva, for five reasons, of which the following is a summary:—

(1). She is identical in form with the Indo-Scythian *Αρδοκπο* or *Αρδοχο* whose name is commonly interpreted as Arddh-ogro (अर्द्धोग्र) or 'half-Siva', i. e., Párvatí.

(2.) Even if it be admitted that the early Guptas had Vaishnava

\* In the northern Bilsar inscription, dated in the year 96, Kumára Gupta is eulogized as the "giver of millions of gold, performer of the Aśwamedha" &c. (*Cunn. Arch. Rep. XI. 20*.)

† Birdwood, *Industrial Arts of India*, I, p. 25

tendencies, the adoption from the Indo-Scythians of the reverse device in question "may well have been a mere act of 'imitation of a foreign design,' irrespective of any aim at demonstration of creed." Reverse devices locally vary, and are not of much significance, e. g., the Sassanians retained the Śiva and Nandī device of Kādphises, and the Muslim Ghaznavis retained the Hindú recumbent bull on their Lahor coinage.

(3.) The female seated on a lion, who appears on the reverse of four types of the Gupta coins, is plainly Párvatī in her form of Dúrgā.

(4.) On four types the same goddess appears in the form of Kumári Devi, associated with her sacred bird the peacock; and

(5.) Skanda, the name of the last of the imperial Guptas, is an *alias* of Kumára Deva, the god of war, son of the goddess Kumári Devī.\*

These arguments seem to me to be of little weight. The interpretation of Ardokro or Ardochro as meaning 'half Śiva' is a very forced one, and I doubt greatly if such a compound as अर्द्धशिवो, or rather अर्द्धशिवी could have in Sanskrit the meaning assigned to it. The name is never written Ardogro, whereas the title of Śiva which is supposed to form an element of the compound is Ugra, and I do not see how the 'g' can be converted into κ or χ, nor why the aspirate at the end of *arddha* should be lost. The supposed compound 'Arddhogra' has no analogy with the genuine compound 'Arddhanári'; it is one thing to speak of a creature as half-female, and quite another thing to speak of Joan as half-John.† The Indo-Scythian goddess may or may not be intended to represent Párvatī, though I do not believe that she was, but I am convinced that her name does not mean 'half-Ugra,' and that such a compound never existed. The name Αρδοχρο or Αρδοκρο is probably a Scythian name, and not an Indian word at all.

If the throned figure is to be identified with any goddess of the modern Hindú pantheon, I consider that she should be identified, as suggested by Wilson, with Śrī or Lakshmī, the benign goddess of fortune, and not with the terrible Párvatī.

The supposed Vaishṇava tendencies of the early Guptas have been believed in chiefly on the testimony of the Bhitari pillar inscription, which, if correctly interpreted by Dr. Mill, proves Chandra Gupta II and Kumára Gupta to have been Vaishṇava, and Skanda Gupta to have

\* J. A. S. B., XXIV (1855) pp. 489-490.

† Cf. Wilson's criticisms in *Ar. Ant.*, pp. 361-362. In the Pa-Shaka coin in the British Museum the name of the goddess is spelled ΟΡΔΟΧ[ΡΟ], a form which it is absurd to identify with 'Arddhogro.' (*This unique coin is described in Mr. Thomas's Indo-Scythian Coins with Hindú Legends*, p. 11.) General Cunningham concurs with me in giving the name of Lakshmī to the goddess, whether seated on the throne or the lotus-flower.

been Śaiva. But the translation of the Bhitari inscription is avowedly imperfect, and, until it has been revised by a competent scholar, is of little use for historical purposes.\*

The interpretation of the device of the throned goddess requires no assumption as to the sectarian preferences of the early Guptas, for the attributes of the figure are manifestly those of Lakshmi rather than of Párvatī, and I venture to affirm that but for the 'half-Siva' interpretation of the word Ardokro, no one would ever have thought of calling the figure Párvatī. The suggestion that the figure of the Ardokro goddess was adopted by Samudra in mere imitation of a foreign design does not appear to be tenable. The coins with this reverse undoubtedly show evident traces of foreign influence, but they are far from being mechanical copies of alien designs. If Samudra Gupta's die engraver had been a mere copyist he would naturally have copied from the coins of Samudra's father and grandfather, but the reverse devices of their coins are totally different both from the Ardokro figure and from each other. Samudra himself employed four distinct reverse devices, and evidently adopted each of them deliberately.

Mr. Thomas' remaining evidence in favour of his interpretation consists in proofs of the Śaiva preferences of Kumára Gupta and Skanda Gupta. But the facts that one of these princes placed on his coins effigies of Kumári Devī and of Dúrgā, and that the name of the other is a synonym of Kumára Deva, by no means prove that all female figures on the reverses of other Gupta coins are intended for forms of Párvatī. I have discussed above some of the representations of standing goddesses, none of whom can with any probability be identified with Párvatī. The peacock of Kumári Devī, and the lion of Dúrgā are never associated with the throned Ardokro goddess. She occurs only on the Javelin and Archer coins of Samudra Gupta, and on the unique Couch coin, and the rare coins forming Class I of the Archer type of Chandra Gupta II.

An emblem, which is very characteristic of the Gupta gold coins, makes its first appearance on the obverse of Samudra's Javelin type. This is a standard bearing on the top the figure of a bird, and having a general resemblance to a Roman eagle standard.

Wilson (who is followed by General Cunningham) was inclined to interpret the bird as meaning Garuḍa, the winged vehicle of Viṣṇu; but this interpretation appears to me forced and improbable. The object indicated is simply a bird, whereas the mythologists describe Garuḍa

\* For the Bhitari inscription see Prinsep's *Essays*, Vol. I, pp. 240, *seqq.* A revised facsimile is given in Cunningham *Arch. Rep.* I, pp. 97—99, and Pl. XXX. A well-edited translation is much wanted, and it is surprising that the want has remained so long unsupplied.

as a monster, half man and half bird. I prefer Mr. Thomas' former opinion that "the most natural and obvious interpretation is to look upon it as designed to represent the peacock, which appears with such frequency on the gold coins, and occupies the entire reverse field of one type of the silver coinage."\*

It is, however, quite possible that the emblem is merely a copy of the Roman eagle, and the term 'bird-standard,' which involves no theory, is the safest to adopt.

In his Archer type Samudra Gupta substitutes for the javelin in the king's hand a bow, and the device thus introduced long remained the favourite obverse pattern. It is found on the coins of Chandra Gupta II, Kumára Gupta, and Skanda Gupta, and is, with few exceptions, the only design used by the rude imitators of the Gupta types, some of whose coins are noticed in the Supplement to the Catalogue.

It seems impossible at present to decide whether the Archer device was an independent invention, or was borrowed from Persia or some other foreign source, and it is equally doubtful whether it has or has not any symbolic meaning. If it has, it may be regarded as another expedient for indicating the analogy between the sun that rules the heavens, and the king who rules the earth. Chandra Gupta II issued gold coins of at least eight different types, but specially favoured the Archer type, specimens of which in large numbers have been found.

The Lyrist type of Samudra Gupta's coinage, which depicts the king as a musician playing the Indian lyre, is interesting in several respects.† The type is rare, and the specimens known are mostly in fine condition, and, with the exception of the India Office example, are broad thin coins well struck, but in singularly low relief. The dress of the king is thoroughly Hindu, but his attitude recalls that of the king on the Indo-Scythian coins classed as 'couch-loungers' by Prinsep. The reverse device is likewise in appearance completely Hindú, though apparently suggested by foreign models. It consists of a female seated sideways to the left on a wicker stool, and holding fillet and cornucopia. The attitude of the goddess, and the form of the stool on which she sits recall the device of Apollo seated on the *δμφαλος*, with its cover of the *ἀγπνὸν* net, as seen on the Seleucid coins of Syria,‡ and I believe that

\* J. A. S. B. XXIV, (1855) p. 494, note. In 'Records of the Gupta Dynasty' (1876) p. 23, Mr. Thomas adopts the Garuda interpretation.

† Line 24 of the Allahabad Pillar inscription mentions Samudra Gupta's accomplishments in singing and playing. (*Prinsep's Essays*, pp. 233 seqq.)

‡ E. g., the coins of Antiochus I, figured in J. A. S. B. Vol. L. for 1861, p. 178, and Pl. XVIII, 14, 15. General Cunningham calls the seat 'cortipa,' but 'omphalos' is more correct.

the resemblance is not accidental; but the closest parallel to the Gupta device is met with in an unexpected place. The goddess on the Gupta coins is almost an exact copy of Demeter as represented on a rare coin of the island of Paros, now in the British Museum, and the resemblance is so close that it is scarcely possible to doubt that in some unknown way both devices must be derived from a common source.

The cornucopia in the hand of the goddess of Samudra Gupta's coins shows that she was intended to have attributes similar to those of Demeter, and she may therefore be regarded as a novel representation of the Hindú Lakshmi, the counterpart of the Greek goddess.

The same reverse device, but with some modifications, and associated with other obverse devices, was adopted by Chandra Gupta II, and Kumára Gupta. The goddess, as she appears on the *Lancer* and *Horseman to Left* coins of Chandra Gupta II, and in varieties  $\alpha$  and  $\beta$  of the *Horseman to Right* type of his son, would seem to be intended to symbolize nearly the same ideas as the effigy on the *Lyrist* pieces of Samudra. In variety  $\gamma$  of Kumára's *Horseman to Right* type, and in all the *Horseman to Left* coins of the same king, the goddess is represented in the act of feeding a peacock, and may, therefore, be identified as Kumári Devi, to whom that bird is sacred.

In the gold coinage the peacock (except, perhaps, as part of the so-called 'peacock standard') appears to be peculiar to the mintages of Kumára Gupta Mahendra. The goddess on the reverse of his *Combatant Lion* type stands while she feeds the sacred bird. In his *Peacock* type the bird is still more prominent, for on the obverse the king is feeding one peacock, and on the reverse, the goddess, presumably Kumári Devi, rides on another. There can be little doubt that in this type at all events the king is presented in the double character of the human king and the divine Kumára Deva. The peacock devices of the Gupta coinage appear to be Hinduized adaptations of the designs of the Roman coins which bear representations of the peacock associated with Juno, or with a deified lady of the imperial house. An exact prototype of the peacock with expanded tail, which is found on the silver Gupta coins, and on var.  $\beta$  of Kumára Gupta's gold *Peacock* type, may be seen on the reverse of a coin of Julia Augusta, who was a daughter of Titus and died between A. D. 81 and 90.\*

A coin of Paulina (A. D. 217-238), whose life probably extended into the early years of the reign of Chandra Gupta II, exhibits the peacock in a manner strikingly similar to the device on some of the silver

\* Trésor de Numismatique, Iconographie des Empereurs Romains; Pl. XXII, 11.



coins of Kumára Gupta. Another coin of Paulina's represents her in the character of Juno riding on a peacock, but the treatment of the subject differs from that used by the Gupta artists.\* A standing peacock, like that on the first mentioned coin of Paulina's, appears on a coin of Mariniana, (*circa* 250 A. D.)†; and a coin of Manlia Scantilla Augusta (193 A. D.) exhibits a standing figure of Juno with sceptre in left hand, and holding in her right hand a *patera* over a peacock standing at her feet.‡

In the Boy and Battle-axe type of Samudra Gupta it is interesting to observe the reminiscence of Scythian influence in the form of the battle-axe, with which the king is armed, as representing the god of Death. The place of the usual bird on the top of the standard is taken by a crescent moon. The same crescent-tipped standard occurs on the reverse of the unique Tiger coin of the same king, on the obverse of which the king is depicted as slaying a tiger.§

The obverse device of this coin is the model of three types of Chandra Gupta II, and two of Kumára Gupta Mahendra, in which the tiger is replaced by a lion. I believe that these devices had some symbolic meaning but am not able to make it out. They may have been suggested by the Greek representations of Hercules contending with a lion.

In the Archer type of Chandra Gupta II we first meet with the reverse design No. V, which subsequently became a common conventional pattern, and was used almost exclusively by the obscure princes who rudely imitated the Gupta coinage. The device consists of the figure of a goddess facing front, seated cross-legged on an expanded lotus-flower, and holding in her left hand a lotus flower, and in her right the 'fillet' or 'noose.' The scholars who give the name Párvatí to the Ardokro goddess, of course bestow the same name on the lotus-throned divinity, but I cannot perceive in the latter device any symbolism specially suggestive of the attributes of Párvatí, whereas the symbolism used is thoroughly appropriate to express the ideas personified as Lakshmí. In justification of my views regarding the symbolism of the reverse devices of the Gupta coins I may appeal to the following description of the attributes of Lakshmí, which is based on the best authorities:—'Laksh-

\* *Ibid.*, *ibid* Pl. XLVIII, figs. 5 and 4.

† *Ibid.*, *ibid.*, Pl. LII, 3.

‡ *Ibid.*, *ibid.*, Pl. XLI, 1.

§ In his *Records of the Gupta Dynasty* (1876) p. 21, Mr. Thomas calls the design a 'Garuda standard,' but I am satisfied (after examination of the coin), that the object on the top of the standard is rightly described as a crescent in the same author's *Revised Catalogue* (1858).

mī, called Śrī, is Viṣṇu's *śakti*. She is the goddess of good luck and plenty...She is worshipped by filling the corn-measure with wheat or other grain, and thereon placing flowers. She is represented as a lovely and benign woman, robed in yellow, holding a lotus in her hand, and seated on a lotus, or beside Viṣṇu. Sometimes, as is likewise Viṣṇu, she is painted all yellow, and has four arms, and she holds in one of her right hands a rosary, and the *pāśa* or cord in one of her left. This cord is seen also in the hands of Varuna and Ś'īya, and is emblematical of the sea, which girds the earth."\*

It is impossible to read this description, and not to see that it is in remarkably close accordance with the delineation both of the Ardokro goddess, and of the lotus-throned divinity. But it is quite inapplicable to Pārvatī as ordinarily conceived, and the symbolism of the two coin-devices in question is equally inappropriate to the stern and terrible goddess.

I have therefore no doubt that the goddess who is seated on a throne in Samudra's coins, on a lotus flower in the coins of Chandra Gupta II and his successors, and also (in certain cases, as already specified), the divinity seated on the wicker stool, are all intended to express substantially the same conception, that of the benign and kindly Good Fortune, the bestower of happiness and plenty; the same who was named *τύχη* and Demeter by the Greeks, and Fortuna, Ceres, Abundantia, etc. by the Romans.

Although I have been at so much pains to distinguish between Pārvatī and Lakshmī, I am aware that the two concepts sometimes coalesce, and become indistinguishable. The names and attributes of gods and goddesses, in India or elsewhere, are all nothing more than the feeble efforts of the human imagination to express by metaphor and symbol imperfectly apprehended ideas of the attributes of the unspeakable divine nature, and it is futile to attempt to draw sharp lines of demarcation between these symbolical expressions. Now one, and now another idea predominates in the symbolism, and "in any lengthened description of one Hindū deity it is almost impossible to avoid mixing up its character and attributes with those of another."† Nevertheless, the ideas personified severally as Lakshmī and Pārvatī are ordinarily kept quite distinct, and nothing but confusion of thought can result if the name of Pārvatī is given to a personification possessing all the attributes of Lakshmī.

\* Birdwood, *Industrial Arts of India*, Vol. I, p. 58.

† Birdwood, *Industrial Arts of India*, Vol. I, p. 59. As 'Anna Pūrṇā,' Pārvatī is identical with Lakshmī, *ib.* p. 61.

The only Gupta kings who appear in the coin devices as mounted on horseback are Chandra Gupta II and his son Kumāra Gupta Mahendra. In the later coins of Prakāsāditya the device consists of a horseman slaying a lion or dragon, but the execution of the design is very poor.

The rare Lancer coins of Chandra Gupta II are designed and executed with considerable freedom and spirit. The device may be an imitation of the very similar device on certain Macedonian coins, transmitted through intermediate channels.\* The rayed turban or helmet of the king in one specimen (*Ar. Ant.* XVIII, 17) was perhaps suggested by the rayed head of Antiochus Epiphanes.† It is noticeable that a crescent is found in the field, either on obverse or reverse, of each of the four Lancer coins known to me.

The Horseman to Left coins of Chandra Gupta II, which are also very rare, resemble generally his Lancer coins, but the horse is turned to the left, the lance is wanting, and there is no crescent in the field.

Kumāra Gupta Mahendra copied both these types of his father's coinage, but with some modifications. His Horseman to Right coins correspond with his father's Lancer coins, the lance being omitted, and his Horseman to Left coins differ from the closely similar coins belonging to his predecessor chiefly in the insertion on the reverse of the peacock, the especial emblem of Kumāra Gupta.‡

The fact that Chandra and Kumāra Gupta used indifferently dies in which the horseman was turned to left or right is worth noting, because a change in the direction of an obverse head on the coinage has sometimes been regarded as an indication of a change of dynasty.§

In some specimens of the curious Lion and Horseman coins of Prakāsāditya a small bird-standard is seen over the horse's head. The meaning of the character below the horse in this type, which seems to be intended for ▼ 'u', is not known.

I am well aware that the foregoing account of the types and devices of the Gupta gold coins is far from being complete and satisfactory, but it is the best that I can give at present, and may prove the means of stimulating further research. The attribution of the several disputed types is discussed in the Catalogue.

\* For such Macedonian coins see Mionnet, Pl. LXX, 8, and Trésor de Numismatique (Rois Grecs), Pl. VIII.

† Catalogue of Seleucid Coins, Pls. XI and XII.

‡ Cf. "That King gave birth to a son, even as did Hara to the rider of the peacock (scil. Kārtikeya or Kumāra the god of war). Forward in battle and renowned strength, this son was named Kumāra Gupta." (*Aphsar inscription of later Guptas*, line 7: in *J. A. S. B.* XXXV, Pt. I, p. 273).

§ Records of the Gupta Dynasty, p. 51, with reference to Toramāpa's coins.

## Section III.

## MONOGRAMMATIC EMBLEMS.

The so-called monograms (with one doubtful exception) occur only on the reverse of the Gupta gold coins, and, when present, are generally placed over the right shoulder of the goddess.

The forms assumed by these monogrammatic emblems on the coins accessible to me are shown in Plate IV. The most common forms consist of a horizontal line, or two parallel lines, surmounted by either three or four dots or short prongs, and having a square or lozenge attached below by one corner.

Sometimes the square or lozenge is replaced by a cross, and sometimes by other devices, and occasionally the prongs or dots above the horizontal line or lines are wanting. One form (No. 25), which I know only from a drawing, departs altogether from the standard pattern. Examination of the plate will show the large variety of minor modifications in detail which occur.

What is the origin and meaning of these mysterious marks?

To this question I can give no positive and satisfactory answer, but I am not without hope that the distinct enunciation of it, and the systematic presentation of the monogrammatic emblems as they actually occur may suggest to other enquirers the correct solution of the problem.

The following statement exhibits the monograms which have come under my observation, arranged according to reigns:—

|                            |      |                                                                                                                 |
|----------------------------|------|-----------------------------------------------------------------------------------------------------------------|
| Ghatot Kacha.....          | Nos. | 1; 2; 4a.                                                                                                       |
| Chandra Gupta I .....      | „    | 3a; 4b; 5; 8d; 22b.                                                                                             |
| Samudra Gupta.....         | „    | 3a; 4c; 6a; 6b; 8a; 9;<br>11; 19a; 20a; 20b; 21;<br>22.                                                         |
| Chandra Gupta II.....      | „    | 3a; 3b; 4c; 7a; 7b; 8a;<br>8b; 10a; 10b; 10c; 12;<br>15; 16; 17a; 17b; 18;<br>19a; 19b; 20a; 21; 22;<br>23; 24. |
| Kumára Gupta Mahendra..... | „    | 8a; 8b; 8c; 10c; 17c; 17d;<br>19b; 20a; 25.                                                                     |
| Skanda Gupta .....         | „    | 3a; 3b; 4c?; 8a.                                                                                                |
| Doubtful.....              | „    | 8a; 8e; 10a; 13; 14; 19a.                                                                                       |

The following types have no monogram;—

|                        |                |
|------------------------|----------------|
| Samudra Gupta .....    | Aśwamedha.     |
| „ „ .....              | Tiger.         |
| Chandra Gupta II ..... | Lancer, var. a |

|                             |                               |
|-----------------------------|-------------------------------|
| Chandra Gupta II .....      | Horseman to Left.             |
| " " " .....                 | Lion-Trampler, var. $\beta$ . |
| Kumára Gupta Mahendra ..... | Horseman to Left.             |
| " " " .....                 | Peacock.                      |

In the following types the monogram is sometimes present, and sometimes wanting:—

|                             |                         |
|-----------------------------|-------------------------|
| Samudra Gupta.....          | Lyrist.                 |
| Chandra Gupta II .....      | Swordsman and Umbrella. |
| Kumára Gupta Mahendra ..... | Horseman to Right.      |

We learn from the last two lists that the monogram was not indispensable, and was frequently omitted, though more usually inserted.

The monogrammatic devices on the Græco-Bactrian coins, with which the Gupta mint-masters must have been familiar, are real monograms, combinations of letters, usually those of the Greek alphabet.

The so-called monograms on the Gupta coins, and the similar ones on the Indo-Scythian mintages, are certainly not combinations of alphabetical characters, and the application to them of the word monogram, which has become usual, is, strictly speaking, a misnomer. Kittoe preferred to designate them by the term 'emblem', but that word is inconveniently vague, and, for want of a better term, I follow the ordinary practice, and call the marks in question monograms.

Few, if any, of the forms of the Gupta monograms are exactly the same in every detail as those met with on the Indo-Scythian coins, but the general appearance of the monograms on the two series of coins is obviously identical, and many of the Gupta forms are only trivial variations of the Indo-Scythian patterns.

Consequently, whatever interpretation is given to the Gupta monograms must be sufficiently comprehensive to include the analogous and similar Indo-Scythian ones.

It appears to be established that some of the Græco-Bactrian monograms are names, more or less abbreviated, of mint-cities. General Cunningham's ingenious interpretations of a large number of these monograms cannot be implicitly accepted, but the proposition that *some* of those which "are common to a number of different princes" express the names of the mint-cities may safely be admitted. Others probably indicate the names of mint-masters or other functionaries.\*

The monogrammatic emblems on the Indo-Scythian and Gupta coins look as if intended to take the place of the Græco-Bactrian monograms, and the hypothesis that they bear the same meaning or meanings

\* Coins of Alexander's Successors in the East, in Num. Chron. N.S. VIII (1868), pp. 185 seqq.

naturally suggested itself. Wilson noticed that the three and four-pronged patterns of monogram were continued from the coins of the Indo-Scythian sovereigns Kadphises, and Kanerki on those of the Gupta kings, and observed that "agreeably to the purport which there seems reason to assign to these monograms, the recurrence of this emblem on all these coins should denote the place of their coinage."\*

But he hesitated to adopt this theory because it appeared to him that the Indo-Scythian dominions must have lain far to the northwest of the Gupta kingdom, and he suggested the alternative hypothesis that the Gupta monograms might be merely "a proof of imitation" of the Indo-Scythian coinage, and "introduced without any definite object." Such a suggestion is, on the face of it, improbable, and it is at once disproved by a careful examination of the monograms. A mere copyist would have tried to copy the Indo-Scythian monograms as they stood, and, however he might have failed in the mechanical execution, the evidence of the attempt to copy would have been unmistakeable. But, as I have already remarked, and as any one can readily verify by comparing my plate of monograms with that in the *Ariana Antiqua*, the Gupta monograms, while following the Indo-Scythian in the general pattern, differ in detail, and it is incredible that the systematic variety which exists could be the result of chance caprice. Moreover, the mechanical execution of the Gupta monograms is nowise inferior to that of the Indo-Scythian. No one can study the designs of the better types of the Gupta gold coinage without seeing that the artists who cut the dies, though indebted in some respects to foreign models, yet possessed considerable originality, and knew how to assimilate and nationalize the conceptions of alien art. The hypothesis that the Gupta monograms are the work of blind and unintelligent imitators may therefore be dismissed without doubt or hesitation.

The hypothesis that the monograms indicate the mint-cities is much more plausible, but is not altogether satisfactory. The Indo-Scythian coins are found chiefly in the Panjáb and neighbouring parts of Afghánistán where Gupta coins are never found,† whereas the Gupta gold coins, as will be proved in a subsequent section, have been found for the most part in the province of Benares and the neighbouring districts. It is extremely improbable that the Panjáb Indo-Scythian and the Gupta coins should have issued, to any considerable extent, from the same mints, or should bear cognate mint-marks. Indo-Scythian coins of Kadphises and

\* *Ar. Ant.* p. 418.

† In *Arch. Rep.* XIV. p. 65, General Cunningham mentions the finding of one Gupta coin among upwards of 1,000 of other kinds at Sunit near Ludiána in the Panjáb.

Kanerki are, however, found in N. E. Oudh and Benares, and it is possible that certain of the Indo-Scythian provincial mints may have been occupied by the Gupta kings when they shook off the Indo-Scythian yoke, and that the 'monograms' on the Gupta and *eastern* Indo-Scythian coins may indicate mint-cities. Unfortunately no detailed catalogue of Indo-Scythian coins has yet been published, and the statistics of their *provenance* have not yet been analysed.

The occurrence of coins together in a hoard raises a presumption that they proceeded, if not from a single mint, at least from mints not very far distant from each other. Few details as to the composition of the various hoards of Gupta coins are available, but when such details are known, we find very various monograms associated in a single hoard. Thus, the 32 described coins of the Bharsar hoard exhibit monograms as follows :—\*

|             |                                                                                                                  |
|-------------|------------------------------------------------------------------------------------------------------------------|
| No. 8a..... | 1 coin of Samudra Gupta ; 6 of Chandra Gupta II ; 1 of Kumára Gupta Mahendra ; and 2 of Prakásáditya ; total 10. |
| No. 3a..... | 2 of Samudra Gupta.                                                                                              |
| No. 4c..... | 3 of Samudra Gupta ; 6 of Skanda Gupta ; total 9.                                                                |
| No. 15..... | 2 of Chandra Gupta II.                                                                                           |
| No. 25..... | 2 of Kumára Gupta Mahendra.                                                                                      |
| No monogram | 1 of Chandra Gupta II ; 6 of Kamára Gupta Mahendra ; total 7. Grand total 32.                                    |

The above considerations seem sufficient to throw doubt on the theory that the Gupta (and consequently the Indo-Scythian) monograms are the indications of mint-cities.

Nor does it seem possible that they should be the marks of mint-masters or other official persons, for the same monogram runs through several reigns. For example, the monogram No. 3a is found on coins of Chandra Gupta I, Samudra Gupta, Chandra Gupta II, and Skanda Gupta, and its use, therefore, continued for at least a hundred years.

If then these monograms are not the result of blind imitation, nor the devices of mint-cities, nor the marks of public functionaries, what are they ? It seems to me most probable that (though they *may* be mint-marks) they are religious emblems or symbols of some sort. The description of types in the last preceding section will have left no doubt on the reader's mind that religious symbolism and the effigies of deities appear everywhere on the Gupta gold coins, as they did on their Indo-Scythian forerunners, and it is reasonable to suppose that the same love for religious symbolism dictated the selection of the so-called monograms.

\* For an account of this hoard, see *post*, Sec. V.

I cannot profess to explain the precise significance of any of the Gupta monograms, but it is possible that some Hindú scholar may be able to elucidate the subject.

Mr. Thomas has called attention to the curiously close likeness between monogram No 4a, and the Egyptian symbol for the bee, which was the sign royal in the Hieratic character.\*

A trident which bears a resemblance to some of the Indo-Scythian and Gupta monograms occurs, detached like them, in the field of a coin of Rhescuporis II, king of the Bosphorus (A. D. 17 to 34).†

The standing figure of Victory, who appears on some coins of Azes holds in her right hand a four-pronged symbol which is identical with the upper part of so many of the Indo-Scythian and Gupta monograms.‡

These instances of resemblance between the monograms in question and other symbols may be cases of casual coincidence, but I have thought it worth while to note them on the chance of their suggesting a correct solution of the problem of the origin and meaning of the so-called monograms of the Indo-Scythian and Gupta dynasties.

#### *Section IV.*

##### WEIGHTS.

The authors of essays on Indian numismatics have in general contented themselves with more or less complete descriptions of the devices and legends of coins, and have paid little attention to weighments.

Numismatists in Europe of late years have become alive to the importance of dry details of the weight of coins, and have spared no pains to obtain copious lists of weights as materials for induction.

A knowledge of the weight standards of ancient coins is indispensable for the attainment of accurate notions respecting the history and development of coin types, and helps to throw light on the ill-understood commercial relations of the states of the ancient world. The scholar who devotes himself to the examination of the numismatic treasures of Europe cannot hope to do more than fill in the blank spaces of a sketch which has already been drawn in firm outlines by the hand of history. The enquirer who ventures to explore the labyrinth of Indian numismatics can expect but little help from the friendly hand of the historic muse, but is perhaps compensated for the difficulties which he encounters by the unfailing hope of discovery, and by the consciousness that he is tracing the plan of the foundations on which history should rest.

\* Records of the Gupta Dynasty, p. 21, note.

† Trésor de Numismatique, Rois Grecs, Pl. XXV, 12.

‡ Ar. Ant. Pl. VI, figs 12 and 18.



So general has been the neglect in Indian publications of all systematic study of coin weights, that I may be pardoned if I dwell for a moment on its importance, and call to witness an expert who has studied European and Oriental numismatics with equal ardour.

"The history of the standards of weight on which Greek coins were struck did not, until quite recently, become a subject of serious study. .... Nothing has done more of late years to give a scientific form to Greek numismatics than the great attention given to weight standards. The fact has been recognized that a coin is, after all, but a stamped piece of precious metal, and that its value was derived, when it was issued, not from the stamp, but from the metal. Distinguished scholars like Hultsch and Brandis have in consequence spent years of their lives in weighing coin after coin, recording the results, and trying thence to reach principles. The greatest of living archaeologists, Professor Mommsen, has given much time to the study of the weights and developments of Greek and Roman coins, and his strength has opened a way through jungles which were before impenetrable obstacles to science."\*

It cannot be expected that Anglo-Indian amateur numismatists should devote years of their lives to weighing coins, but, even with such limited opportunities as circumstances permit, they may collect a goodly mass of the necessary details, and do something to give to Indian archaeology that scientific form which it frequently lacks.

The weights of all coins mentioned or described in my catalogue are there noted, so far as they could be ascertained, and the results are exhibited in the Table of Weights, which deals with 177 coins. Examination of the devices has already proved that the Gupta gold coinage immediately succeeded that of the Indo-Scythian princes, and this conclusion is confirmed by the study of the coin weights.

Few details as to the weight of the Indo-Scythian coins are available, but, according to Mr. Thomas, the coins of the Kadphises group average 122·4 grains, while those of the Kanerki series are somewhat lighter, but often weigh 122 grains. Some Indo-Scythian pieces weigh as high as 125 grains.†

The source from which the Indo-Scythians derived the supply of gold for their extensive mintages is not known with certainty, but is conjectured, and with much probability, to have been the constant stream of Roman *aurei* which in those times poured into India in exchange for her silk and other commodities.

\* Types of Greek Coins by Percy Gardner, 1883, p. 62.

† Early Faith of Aśoka (*J. R. A. S. IV N. S. p. 223*). It is possible, and even very probable that the Indo-Scythian and Gupta Dynasties and coinages to a certain extent existed contemporaneously in different parts of the N. W. P. and the Panjáb.

The existence of this eastward drain of gold is fully proved by the testimony of Pliny, as well as of other witnesses. The words of Pliny are so vivid and explicit as to be worth quoting afresh. "*Minimâque computatione millies centena millia sestertiûm annis omnibus India et Seres peninsulaque [scil. Arabia] imperio nostro adimunt. Tanta nobis deliciae et feminae constant.*"\* Again he observes that the trade with India was worth taking some trouble to maintain. "*Digna res, nullo anno imperii nostri minus H. S. quingenties exhauriente India, et merces remittente, quæ apud nos centuplicato veneant.*"†

The *aureus* was adopted first by Julius Cæsar as a regular element of the Roman currency, and his standard is said to have been 125·66 grains but his coins generally range between 120 and 125 grains. It would therefore appear that the Indo-Scythian gold coinage is based on that of Julius Cæsar, and not on the Macedonian stater, or Persian daric, of which the standard was 134·4 grains, or two Attic drachmae. This fact helps in some measure to settle the vexed question of the date of the Indo-Scythian kings, and consequently of their Gupta successors.

The weight of the Roman *aureus* after the death of Julius Cæsar gradually declined, and in the reign of Nero is stated to have averaged 115·39 grains.‡

The average weight of 4 coins of Ghaṭot Kacha is 114·95, and the heaviest coin weighs 118. The average weight of the *aurei* of Augustus in the British Museum is 121·26, and it would therefore at first sight appear as if the coins of Ghaṭot Kacha were based on the Roman coinage intermediate between Augustus and Nero. But a fine coin of Chandra Gupta I, son and successor of Ghaṭot Kacha, which is in the British Museum, weighs 123·8, and this fact indicates that Chandra Gupta's coinage was adapted to a standard of about 125 grains, and renders it probable, though not certain, that Ghaṭot Kacha followed the same standard.

I assign the coins of the King and Queen type alone to Chandra Gupta I, and the weight of 4 of these averages 117·57. The light weight, of the majority of the coins of Ghaṭot Kacha and his son appears to be due to wear and tear.

The details for the weights of the six types of Samudra Gupta's

\* Pliny, Hist. Nat. XII, 41.

† Pliny, Hist. Nat. VI, 26.

‡ The average weights 125·66 and 115·39 for Julius Cæsar and Nero respectively are those stated by Letronne, as quoted in Smith's Dict. of Antiq. and in Thomas' Early Faith of Asoka, *ut supra*. Mr. Gardner informs me that the *aurei* of Julius Cæsar average 120 to 125, and those of Nero 112 to 114. I adopt Gen. Canningham's estimate of the weight of the daric; Mr. Heard makes it 130 grains.

coinage will be seen on reference to the table. The heaviest coin of his reign is one of the Boy and Battle-axe type, which weighs 123·4, and the next heaviest is a Lyrist coin weighing 122 grains.

The 5 specimens of the Lyrist type weighed are all in good condition, and yet exhibit a remarkable variation in weight from 111 to 122 grains, of which I cannot offer any explanation. The  $\beta$  variety of Samudra's Archer type is remarkable for its light weight, the highest weight being 114 grains.

The Aśwamedha coins average 116·18, and do not exceed 117·7, but all specimens weighed are more or less worn. The mean of the weights of the heaviest coins, one of each type, is 118·87, for the reign of Samudra Gupta. With the exception, perhaps, of the  $\beta$  variety of the Archer type, I do not believe that the weight standard was intentionally lowered during this reign.

The coins of Chandra Gupta II are somewhat heavier, but for the most part follow the same standard as those of his predecessors. The Wheel coins (Archer type, class II  $\beta$ ) form a remarkable exception, the highest weight (two specimens) being 132·5, and the average weight of 8 coins being 129·77, which figures agree substantially with those for the reign of Skanda Gupta. It would seem as if these Wheel coins were struck on the daric or Macedonian stater standard of 134·4 grains. I can offer no explanation of this fact, but I believe that it is an indication of some important historical event. These Wheel coins of Chandra Gupta's and the coins of Skanda cannot be intended as equivalent for Roman *aurei*, for the heaviest known *aureus* is one of Pompey, weighing 128·2. It is possible that the immediate model of the coins in question was found in the issues of the Seleucid kings of Syria, which frequently weigh 130-132 grains, and are sometimes found in India.

A few coins of the Archer type, class II *a* (the commonest variety) and of the same type and class var.  $\gamma$ , exceed 125 grains, the heaviest specimen weighing 127·6, but the average for the type (excluding the Wheel variety) is about 123 grains, and I believe, therefore, that the coins were intended to follow the old Roman and Indo-Scythian standard of about 125 grains.

The mean weight for the reign, calculated as in the case of Samudra Gupta, and excluding the Wheel variety, is 121·61.

In the reign of Kumāra Gupta Mahendra the weight standard was certainly to some extent raised, the mean weight for the reign, (calculated in the same manner as above) being 126·0 grains. The heaviest coin of the reign is one of the Peacock type, weighing 128·6, and very few specimens of any type weigh less than 123 grains. The standard would therefore seem to have been the ancient Lydian standard of 130

grains. Why Kumára Gupta should have reverted to this standard for his coinage is at present an unsolved problem. Skanda Gupta's coinage occurs in two types only, the Archer and the King and Queen. The heaviest Archer coin weighs 132·5, and the average weight of 9 coins of this type is 129·21. The King and Queen type is known from two specimens only, and but one of these has been weighed; its weight is 128·8. These can, therefore, be no doubt, that, as has already been observed, the coinage of Skanda Gupta conforms to the same standard as the Wheel variety of the Archer type of Chandra Gupta II. .

The investigation has thus established the remarkable fact that the undisputed coins of the imperial Gupta Dynasty were struck according to at least three distinct standards of weight, of approximately 125, 130, and 134·5 grains respectively.

When we turn to the later coins included in the Supplement to my Catalogue another and more striking change in the weight standard presents itself. These coins are all, except the Prakáśáditya coins, of the Archer type, with reverse device of a goddess (Lakshmi probably) seated on a lotus-flower. The execution is rude, and the metal sometimes debased. Of the coins bearing the name of Chandra, the weights of three are known, the average being 145·66, and the highest 148. The corresponding figures for 4 coins inscribed with the name Kumára, or its first syllable, are 146·3 and 148·7. The only gold coin of Skanda Gupta Kramáditya which has been tested, weighs 141·4. The coins of Nára Gupta Báláditya average 145·66, with a maximum of 148·7, and the Lion and Horseman coins of Prakáśáditya show an average of 145·6 and a maximum of 146·2.

These figures demonstrate that all these coins were struck according to one standard, and that quite different from any of the standards adopted for the undisputed mintages of the imperial Gupta sovereigns. What was this standard? It seems to me that it was the ancient Hindu weight and coin, the *suvarṇa*, or golden *Kārsha* of 80 *ratís*.

General Cunningham finds it "for all practical purposes extremely convenient and sufficiently accurate to assume the value of the *ratí* at 1·75 English grain, which is the value that has already been adopted by Mr. Thomas on the evidence of the coins themselves." If this value for the *ratí* be accepted the weight of the *suvarṇa* must be fixed at 140 grains, and the coins now under consideration, whatever they may be, cannot be intended for *suvarṇas*.

General Cunningham observes that "no one to my knowledge has seen a *suvarṇa*," and in the sense that no one has yet discovered an ancient Hindu pre-Alexandrine coin of that denomination, the observation is accurate; but I venture to submit that the coins of Nára Gupta and

his compeers must be considered as revivals of the ancient *suvarṇa*, and that this conclusion is fully warranted by General Cunningham's own researches. He has devoted much time and labour to the task of ascertaining the value of the *ratī*, by weighing the *ratī* seeds (*Abrus precatorius*) and the other kinds of seeds metrically associated with the *ratī* in the Hindu books. The mean of four values of the *ratī* deduced from actual weighments of the seed of the *Abrus* is 1·8143. General Cunningham himself, with the most elaborate precaution, weighed "one thousand sound and tolerably even-sized seeds", with the result that the average weight was 1·823 grain, and Mr. Laidlay's weighments on his behalf gave practically the same result, 1·825.

Weighments of rice and other seeds alleged in the Hindu books to have definite numerical ratios to the weight of the *Abrus* seed gave results varying from 1·791 to 1·825, with a mean of 1·8044. By taking the mean of the two average weights above noted ( $1·8143 + 1·8044 \div 2$ ) says General Cunningham, "we obtain 1·8093 as the true value of the actual *ratī*."\* This expression is not scientifically accurate, because a mere arithmetical average of results obtained from experiments conducted in different ways, and with various degrees of precaution, is *not* entitled to be called a *true value*.

It seems to me that if witnesses are to be weighed and not counted the nearest possible approximation to the 'true value' is to be found in the result 1·823 obtained by General Cunningham from the truly scientific experiment made by himself which he describes, confirmed as it is by the almost identical result, 1·825, obtained by Mr. Laidlay. General Cunningham, therefore, on his own showing, is not justified in assuming 1·75 grain as the value of the *ratī*; and in 1865 he accepted the value 1·823 grain for the *ratī*.† Mr. Thomas arrives at the seductive figure 1·75 by a different method. He shows, for instance, that the Hindu silver coin known as *purāṇa* should contain 32 *ratīs*, and that *purāṇa* pieces actually in existence weigh as high as 55 grains, and then, so far as I understand him, jumps to the conclusion that the full weight of the *purāṇa* was 56 grains. But I cannot see anything in his arguments inconsistent with

\* For Gen. Cunningham's experiments and opinions see his paper 'On the Monetary System of the Greeks in Bactriāna, Ariāna, and India,' in *Num. Chron.* Vol. XIII, N. S. (1873) pp. 187-219, especially pp. 196-7. Mr. Thomas has explained his views in his essays on Ancient Indian Weights (*Num. Chron.* IV, N. S. (1864) pp. 40-58 and 114-132, especially p. 132.) These essays have been republished with additions in the *International Numismata Orientalia*.

† "The old Indian *paṇa* or copper coin of 145·833 grains." (*Coins of the Nine Nāgas etc.*, in *J. A. S. B.* Vol. XXXIV, 1865, p. 120.) The *paṇa* of copper corresponded in weight with the *suvarṇa* of gold.

the assumption that the full weight of the *purāṇa* was 57, or 58, or 59 grains, and must confess to remaining unconvinced by his reasoning, which seems to make insufficient allowance for loss of weight by wear. I believe General Cunningham's 1·823 grain to be the nearest possible approach to the true value of the *ratī*, but, for convenience, would adopt Mr. Laidlay's value 1·825, which only differs from the other by  $\frac{1}{100}$ th of a grain. The scale of Hindu gold coins and weights, will then stand as follows ;—

$$\begin{aligned} 5 \text{ ratīs} &= 1 \text{ māsha} = 9\cdot125 \text{ grains.} \\ 80 \text{ ratīs} &= 16 \text{ māshas} = 1 \text{ suvarṇa} = 146\cdot000 \text{ „} \end{aligned}$$

The silver *purāṇa* will thus be equivalent to 58·4 grains, a result apparently quite consistent with the weights of existing specimens when allowance is made for wear. These results are, I submit, much nearer to the truth than the figures 8·75 and 140 and 56 respectively, as adopted by General Cunningham in his later publications and by Mr. Thomas, and they happen to be very nearly as convenient for purposes of calculation. I would urge, however, that mere convenience of calculation does not justify any appreciable modification of the results arrived at by scientific investigation, and that our business is to get at the truth so far as possible, and to make our arithmetic conform. Tried by this test our coins obviously appear to be intended for *suvarṇas*. To make the point clear I repeat the weights :—

|                                                 |                |
|-------------------------------------------------|----------------|
| <i>Suvarṇa</i> = 80 <i>ratīs</i> @ 1·825 grs. = | 146·00 grains. |
| Av. wt. of Chandra barbarous coins =            | 145·66 „       |
| „ „ Kumāra „ „ =                                | 146·30 „       |
| „ „ Skanda „ „ =                                | 141·40 „       |
| „ „ Nāra „ „ =                                  | 145·66 „       |
| „ „ Prakāśāditya „ „ =                          | 145·60 „       |

It is true that some specimens weigh as much as 148·7, and that a base metal coin of the Kumāra type weighs 150·3, but, considering the rude execution of these coins, and the inferiority of the metal in many instances, I do not think that this excess of weight invalidates the reference of these coins to the *suvarṇa* standard. Whether I am right or wrong on this point, the discussion at least proves that an investigation in detail of the weights of the coins of the Gupta period is not without interest, and may lead to conclusions of some importance.

It is to be regretted that the materials for the discussion are at present comparatively scanty, and I hope that collectors of Indian coins may be induced to pay more attention to the weights of their coins than has hitherto been customary.

*Section V.*

## FIND-SPOTS.

The information concerning the localities in which the Gupta gold coins have been exhumed or otherwise obtained is not so copious as could be desired, and most coin collectors seem to take little interest in ascertaining either the spot where their specimens were found, or the details of the contents of each trove. Yet these points eminently deserve attention. Greek coins usually indicate on their face the locality of the mint where they were struck, but the Gupta and other Indian coins ordinarily have no indication of the sort, and, in the absence of trustworthy written history, the records of the find-spots of coins are almost our only clue to the position of the ancient Hindu mints.

The Guptas, and other dynasties of præ-Muhammadan India, which modern archæological research has rescued from the utter oblivion of centuries, are still for the most part the merest shadows, endowed with names certainly, but without any definite local habitation, and often as unfixed in time as in place.

The fabric, weight, style, devices, and legends of coins help us to fix the chronological position of these dynasties, whose names dance before the eyes of the student in a most perplexing maze. The recorded find-spots of coins, and detailed account of the contents of individual troves should be studied with care equal to that bestowed on the more attractive parts of numismatic science in order to throw light on the position of the old mint-cities, and on the local limits of the dominion of these long-forgotten sovereigns. Full details of the contents of hoards of coins when skilfully used, can be forced to yield to the historian many valuable hints.

These few observations will, I trust, be deemed sufficient justification for the elaboration with which I have worked out this part of my subject, so far as the meagre materials available would permit. I hope that collectors will be good enough to impart to the Society additional facts to complete the imperfect information at my command, and to correct any erroneous inferences which may be based upon insufficient premises.

Professor Wilson, with his usual caution, declined to commit himself to any definite opinion as to the seat of the dominion of the Gupta kings, or the position of their mint-cities, and contented himself with the remark that "all that can be affirmed of them (*scil.* Gupta gold coins) with any degree of certainty is that they are coins of the west and north-western provinces of Hindustán." He also pointed out that these coins are not found in the Panjáb or Afghánistán.\*

\* *Ariana Ant.* p. 417.

Prinsep treated this topic with greater explicitness, but, as will be shown presently, with less accuracy. "Kanauj," he says, "has been fixed on as the locale of the present class of gold coins, for the obvious reason that they are most frequently found in its ruins, not that any history ascribes them to this town."\* In another passage he appeals again to the "frequency of his coins discovered at Kanauj" as a reason for fixing Samudra Gupta's capital at that place.† In a subsequent essay Prinsep to some extent corrects his former attribution of the majority of the coins to Kanauj, and observes, "Since my former paper on the Gupta coins of Kanauj appeared, very important acquisitions have been made to our knowledge of this before unknown dynasty, through the medium of coins and inscriptions; for both of which we are almost entirely beholden to the researches of Lieut. Cunningham and Mr. Tregear in the neighbourhood of Benares."

After discussing the passage in the Vishnu Purāna, which defines the territory of the Guptas of Magadha as extending "along the Ganges to Prayāga" (Allahabād), he remarks that "the sites, whence these coins have been most frequently obtained, certainly agree with this description."‡

A few pages later Prinsep states that the Gupta gold coins are "discovered in greatest quantity at Kanauj, Jaunpur, Gayā, and even occasionally in Bengal."§

Abstaining for the moment from any comment on the statements above quoted, I shall proceed to state all the facts which I have been able to ascertain respecting the find-spots of the Gupta gold coins; first enumerating the hoards known to me, and then giving statistics of individual coins, including some which formed parts of certain of the hoards mentioned.

172 so-called "gold darics" were found near Benares in the time of Warren Hastings, who sent them home to the Court of Directors, considering himself "as making the most munificent present to his masters that he might ever have it in his power to send them.... The story is that they were sent to the melting pot. At all events they had disappeared when Hastings returned to England."|| It is almost incredible that these 172 pieces should have been Persian darics. The

\* *Essays* I, 284.

† *ibid.*, 239.

‡ *ibid.* pp. 365-6, Mr. Tregear collected at Jaunpur 40 miles from Benares; Lt. (now Genl.) Cunningham was then at Benares.

§ *ibid.* p. 375.

|| Genl. Cunningham on the Oxus Treasure Trove in *J. A. S. B.* for 1881, p. 184; and 'India, What can it Teach us,' by Max Müller, p. 8.



latter are extremely rare, only about 40, I believe, being known to exist, and the neighbourhood of Benares is a place extremely unlikely in which to find a large hoard of them. I consider it highly probable that the trove consisted of Gupta gold coins of the prevailing Archer type, which might in those days be easily confounded with the Persian *róšorai*.

Another great golden treasure was found during the reign of Warren Hastings in the year 1783, at Kálí Ghát, ten miles above Calcutta, on the east bank of the Húgli. The hoard comprised over 200 coins, many of which were sent home by the Governor-General and were distributed among the cabinets of the British Museum, East India Company, and other public institutions, where some, at any rate, of the specimens are still to be seen. The coins of this hoard are described by Wilson as being "of rude execution and debased metal," and it is doubtful if any of them are authentic issues of the imperial Gupta dynasty, though agreeing in general design with the Archer type of those issues. A few specimens from this hoard, which I designate by the name of Kálíghát, are noticed in the Supplement to my Catalogue.\*

In 1838 Mr. Tregear dug up some specimens of the Gupta gold coinage in some ruins, known as Jaichandra's Mahal, near Jaunpur. The exact number of the coins so found is not stated, but it does not appear to have been large. Most, if not all, of these coins were subsequently published by Prinsep, and are included in my Catalogue.†

The important trove, which is referred to in the Catalogue as the Bharsar hoard, was found near Benares in 1851 and is described by Major Kittoc as follows:—

"These coins, which are all gold, of different weight and quality, were of a trove of ninety in number, that is, such number were delivered into the treasury. They were found, with about 70 more, by some villagers, buried in a copper vessel, in a mound on which stands the village of Bharsar, in pargana Bharwal, and Thána Chandauli, about twelve miles from Benares, between the Ganges and Kaimnása. Bharsar is the site of one of the many ancient cities, the names of which are lost....."

"Of the number [*scil* recovered] 71 were coins of Chandra Gupta, 69 being of one type of his coinage [*scil*. evidently, Archer type]. Of these, four were retained of the most perfect, and the remainder were sold by auction; they were all more or less defective, and but few of them had even a portion of the legend round the rim perfect, but the

\* Marsden Num. Or., II, 726; *Ariana Ant.* pp. 416-17 and Plate XVIII, figs. 21 seqq. The barbarous coins figured by Marsden were from this hoard. (*Prinsep's Essays*, I, 230.)

† J. A. S. B. III, (1831), 613.

name [in Gupta characters in text] beneath the left arm of the figure was distinct in all of them.\*

Thirty-two coins were retained and described. This hoard being the only large one concerning which details at all copious have been recorded, I think it is desirable to give an analysis of the portion preserved. The thirty-two coins retained comprised the following types and varieties:—

|                                                                 |    |
|-----------------------------------------------------------------|----|
| Samudra Gupta—Javelin type, var. (1)                            | 1  |
| "    "    "    "    "    (4)                                    | 1  |
| "    "    "    Archer    "    " $\beta$ , 2 and a duplicate     | 3  |
| "    "    "    Lyrist    "    "    "                            | 1  |
| Chandra Gupta II—Archer, class II, $\alpha$ ; 2 and a dupl.     | 3  |
| "    "    "    "    "    "    " $\beta$ ; 1 and a dupl.         | 2  |
| "    "    "    "    "    "    " $\gamma$ ; 1 " " "              | 2  |
| "    "    "    "    "    "    " $\delta$ ; 1                    | 1  |
| "    "    "    "    "    "    "    Horseman to Left—            | 2  |
| Kumara Gupta Mahendra — Archer type, var. $\alpha$ ;            | 2  |
| "    "    "    — Horseman to Right, var. $\alpha$ ; 1 and dupl. | 2  |
| "    "    "    — "    "    Left                                 | 2  |
| "    "    "    — Peacock, var. $\beta$ ; —                      | 1  |
| "    "    "    — Combatant Lion                                 | 1  |
| Skanda Gupta — Archer, 3 and 3 dupl.                            | 6  |
| Prakásáditya — Lion and Horseman,                               | 2  |
| Total...                                                        | 32 |

The contents of the hoard seem to indicate that it was buried not very long after the close of the reign of Skanda Gupta, that is to say, (according to the chronology which I adopt), not later than about 400 A. D.; and we thus learn that at that time the mound of Bharsar was an inhabited town. The Lyrist coin of Samudra is noted as being in fine condition, and some of the Skanda pieces were likewise well preserved; a coin of Kumára's is described as much worn, a circumstance which renders it probable that the hoard was deposited at some considerable interval from the time of Kumára's reign. The association in a single hoard of coins belonging to so many reigns, types, and varieties is remarkable, and shows that these various issues were all current together in the province of Benares.

\* Memo. by Major M. Kittoe, Archæological Enquirer, on some Ancient Gold Coins found near Benares in 1851, and submitted by the Government of India for the inspection of the members of the Asiatic Society; with the Memo. on the same by Mr. E. C. Bayley. (*J. A. S. B.* XXI, pp. 399-400, and *Pl. XII*, figs 1-9. The plate was miserably executed by a native). The coins from this hoard are not included in Mr. Thomas' catalogues.

The same volume of the Journal of the Asiatic Society of Bengal which contains the description of the Bharsar treasure trove supplies a notice of some coins found at Muhammadpur, near the Arunkháli River, in the Jessore District of Lower Bengal. They are described as being "all of the Gupta kings of Kanauj [*sic.*] and comprise specimens of the silver coinage of Chandra Gupta, Kumára Gupta, and Skanda Gupta. The metal of these coins is very impure." The hoard included one gold coin weighing 85 grains, which, at that time, Bábú Rájendralál Mitra believed to be a coin of Srí Gupta, but it is evidently of a date much subsequent to Skanda Gupta.\*

Mr. Thomas alludes, with tantalizing brevity, to "a batch of twenty gold coins found at Gopálpur on 'the Ghágra River, on the site of the old village fort, ten miles west of Barhal' in July 1854." Barhal is in the district of Gorakhpur. Seven of these coins "from the mints of Chandra Gupta II" were submitted to Government, and included a specimen of his Archer type, Class I,  $\beta$ . No particulars are recorded concerning the other constituents of the hoard.† General Cunningham informs me that a great hoard was found at Allahabad some twenty years ago consisting of about 200 of the gold Peacock coins of Kumára Gupta. General Cunningham saw a large number of specimens and obtained possession of four, two of which, namely, one of each variety, are still in his cabinet.

About seven years ago twenty or thirty Gupta gold coins were found at Jhúsi opposite Allahabad, comprising two specimens of Kumára Gupta's Archer type, Class I var.  $\alpha$ ; and eight specimens of the same king's Peacock type in both varieties.‡

Recently, thirteen gold coins of the Guptas were found near Húglí, the hoard being composed as follows:—

|                                             |     |
|---------------------------------------------|-----|
| Samudra Gupta — Javelin type .....          | 1   |
| Chandra Gupta II — Archer ,, Class II ..... | 5   |
| Kumára Gupta Mahendra — Archer ,, .....     | 3   |
| „ „ „ — Horseman to Right ,, .....          | 2   |
| „ „ „ — „ „ Left .....                      | 1   |
| „ „ „ — Lion-Trampler ,, .....              | 1   |
| Total...                                    | 13§ |

\* Note on Three Ancient Coins found at Muhammadpur in the Jessore District, by Babu Rájendralál Mitra (*J. A. S. B.* XXI p. 401; *Pl.* XII, *figs.* 10-12). One of these coins belongs to Sasánka (A. D. 600). *Cunningham, Arch. Rep.* III, p. 138.)

† *J. A. S. B.* XXIV (1855), p. 499.

‡ From information kindly communicated by Sir E. C. Bayley.

§ I am indebted to Dr. Hoernle for my knowledge of this hoard, which I designate by the name of Húglí.

Of the eight Gupta gold coins in the possession of Sir E. C. Bayley, three, as above mentioned, were found at or near Allahabad; the rest are believed to have been found either at Kanauj or Allahabad.

The gold coins of the Guptas in the cabinet of Mr. A. Grant were all obtained in Oudh, and mostly near Faizábád (Ayodhyá), except one, which was bought in Bombay. Mr. J. Hooper's specimens were also obtained in Eastern Oudh. Mr. H. Rivett-Carnac has 13 gold Gupta coins, 6 of these were obtained in the province of Benares, 2 were dug up near Allahabad, 1 was procured at Lucknow, 2 at Cawnpore, and 2 at Mathura.

Col. Tod's coins, including the four gold Guptas figured in Trans. R. A. S. Vol. I. Pl. XII, 4th series, were all obtained at Agra, Mathura, Ujjain, or Ajmir, but more precise information respecting them is wanting.

The above notes comprise all the facts which I have been able to collect respecting hoards of Gupta gold coins, and the origin of the collections in various cabinets.\*

I shall now proceed to analyse the available statistics respecting the find-spots of individual coins, including some which were comprised in certain of the hoards already mentioned.

Prinsep was more careful than many other antiquarians have been to record the source from which he obtained his coins. Thirty-seven Gupta gold coins are described in his essays, and the following table of the find-spots of these coins has been compiled from his notes:—

|                                                      |     |     |     |     |    |
|------------------------------------------------------|-----|-----|-----|-----|----|
| From Kanauj ...                                      | ... | ... | ... | ... | 3  |
| „ Jaunpur                                            | ... | ... | ... | ... | 3  |
| „ „ ? (cabinet of Tregear, who collected at Jaunpur) | ... | ... | ... | ... | 11 |
| „ Benares ...                                        | ... | ... | ... | ... | 1  |
| „ „ ?                                                | ... | ... | ... | ... | 1  |
| „ Gayá ...                                           | ... | ... | ... | ... | 4  |
| „ Mirzápur                                           | ... | ... | ... | ... | 1  |
| „ Gházipur                                           | ... | ... | ... | ... | 1  |
| „ not stated                                         | ... | ... | ... | ... | 12 |

Total... 37

In the following general statement, compiled from all the notes of place in my catalogue, the coins described by Prinsep are included.

\* There is nothing to show the *provenance* of any of the coins in the India Office collection. The find-spots of a very few coins in the British Museum collection are recorded, but there is reason to doubt the accuracy of some of the notes. Mr. Theobald does not know where any of his Gupta coins were found, except that one was bought in Benares, and one in Mathurá. Information is likewise wanting concerning the *provenance* of nearly all the coins in the cabinet of the Asiatic Society of Bengal.

The coins of the Bharsar hoard are placed under the head of Benares and those found at Jhúsi under the head of Allahabad. Tod's coins are described as obtained in N. W. India.

For facility of verification the figures are given for each reign. It is necessary to observe that the notes which form the basis of my tables are often vaguely expressed, and that in some instances it is impossible to say whether the coin was exhumed or only bought at the locality named.

TABLE OF FIND-SPOTS.

| <i>Reign.</i>     | <i>Find-spots.</i> | <i>No. of coins.</i> | <i>Total<br/>for<br/>reign.</i> |
|-------------------|--------------------|----------------------|---------------------------------|
| Ghatot Kacha.     | Jaunpur ?          | 1                    | 1                               |
| Chandra Gupta I.  | „ ?                | 1                    |                                 |
| „                 | Gházípur           | 1                    |                                 |
| „                 | Benares            | 1                    | 3                               |
| Samudra Gupta.    | Kanauj             | 1                    |                                 |
| „                 | „ ?                | 1                    |                                 |
| „                 | Saháranpur         | 1                    |                                 |
| „                 | Mathura            | 1                    |                                 |
| „                 | Oudh               | 10                   |                                 |
| „                 | Jaunpur            | 1                    |                                 |
| „                 | Benares            | 7*                   |                                 |
| „                 | Gayá               | 1                    |                                 |
| „                 | Patna ?            | 1                    |                                 |
| „                 | Húglí              | 1                    | 25                              |
| Chandra Gupta II. | Kanauj             | 2                    |                                 |
|                   | Bulandshahr        | 1                    |                                 |
|                   | Cawnpore           | 2                    |                                 |
|                   | N. W. India        | 3                    |                                 |
|                   | Oudh               | 4                    |                                 |
|                   | Gházípur           | 1                    |                                 |
|                   | Jaunpur            | 1                    |                                 |
|                   | „ ?                | 5                    |                                 |
|                   | Mirzapur           | 1                    |                                 |
|                   | Benares            | 12*                  |                                 |
|                   | Gorakhpur District | 7*                   |                                 |
|                   | Huglí              | 5                    | 44                              |

\* The Barhal hoard comprised about 20 Gupta coins, of which 7 belonged to the reign of Chandra Gupta II; it is not known to what reign the remaining coins belonged, and I have therefore excluded them from the table. In the case of the Bharsar hoard I have only taken credit for the few coins described in detail, but the hoard comprised about 160 Gupta coins, of which 71 belonged to the reign of Chandra Gupta II.

| <i>Reign.</i>          | <i>Find-spot.</i>        | <i>No. of coins.</i> | <i>Total<br/>for<br/>reign.</i> |
|------------------------|--------------------------|----------------------|---------------------------------|
| Kumára Gupta Mahendra. | N. W. India              | 1                    |                                 |
|                        | Allahabad (Jhúsi)        | 14                   |                                 |
|                        | Oudh                     | 3                    |                                 |
|                        | Jaunpur                  | 1                    |                                 |
|                        | Benares                  | 9                    |                                 |
|                        | Gayá                     | 2                    |                                 |
|                        | Mahanada                 | 1                    |                                 |
|                        | Midnapur                 | 1                    |                                 |
|                        | Huglí                    | 7                    | 39                              |
| Skanda Gupta.          | Kanauj                   | 1                    |                                 |
|                        | Oudh                     | 1                    |                                 |
|                        | Jaunpur ?                | 1                    |                                 |
|                        | Benares                  | 1                    |                                 |
|                        | Gházípur                 | 1                    |                                 |
|                        | Mahanada                 | 1                    | 6                               |
|                        | Total for all reigns ... | ... ..               | 118                             |

The following figures give the meagre information available concerning the find-spots of the coins mentioned in the Supplement to the Catalogue :—

|                     |           |   |         |
|---------------------|-----------|---|---------|
| Chandra             | Oudh      | 1 | 1       |
| Kumára              | Kálichát* | 1 | 1       |
| Skanda              | Gayá      | 1 | 1       |
| Nára                | Oudh      | 1 |         |
| "                   | Kálichát* | 1 | 2       |
| Prakásáditya        | Kanauj    | 1 |         |
|                     | Benares   | 2 | 3       |
|                     |           |   | Total 8 |
| Grand total 118 + 8 |           |   | 126     |

The next following statement exhibits a result of the investigation which may surprise some of my readers.

I. Coins obtained at Kanauj (including 1 doubtful case).

|                  |     |     |     |   |
|------------------|-----|-----|-----|---|
| Samudra Gupta    | ... | ... | ... | 2 |
| Chandra Gupta II | ... | ... | ... | 2 |

\* The Kálichát hoard comprised over 200 coins, but its detailed composition is not known.

|      |                                               |     |     |     |     |    |           |
|------|-----------------------------------------------|-----|-----|-----|-----|----|-----------|
|      | Skanda Gupta                                  | ... | ... | ... | ... | 1  |           |
|      | Prakásáditya                                  | ... | ... | ... | ... | 1  | Total 6   |
| II.  | Coins obtained west and north-west of Kanauj. |     |     |     |     |    |           |
|      | Samudra Gupta                                 | ... | ... | ... | ... | 2  |           |
|      | Chandra Gupta II                              | ... | ... | ... | ... | 6  |           |
|      | Kumára Gupta Mahendra                         | ... | ... | ... | ... | 2  | Total 10  |
| III. | Coins obtained east of Kanauj.                |     |     |     |     |    |           |
|      | Ghaṭot Kacha                                  | ... | ... | ... | ... | 1  |           |
|      | Chandra Gupta I                               | ... | ... | ... | ... | 3  |           |
|      | Samudra Gupta                                 | ... | ... | ... | ... | 20 |           |
|      | Chandra Gupta II...                           | ... | ... | ... | ... | 36 |           |
|      | Kumára Gupta Mahendra                         | ... | ... | ... | ... | 38 |           |
|      | Skanda Gupta                                  | ... | ... | ... | ... | 5  |           |
|      | Doubtful                                      | ... | ... | ... | ... | 7  | Total 110 |
|      | Grand total 126                               |     |     |     |     |    |           |

The above total refers only to the coins described in detail, but, when the entire contents of the Barhal, Allahabad and Bharsar hoards are included, the total of indisputably Gupta coins found east of Kanauj will be about 480. If the entire Kálighát hoard of rude coins of Gupta type be included, the total must be raised to about 690, and, if it be admitted that Warren Hastings' 172 "gold darics" from Benares were Gupta coins, the grand total would amount to about 860. In any case the figure for Kanauj stands at 6. The fact is therefore established with mathematical certainty that Kanauj supplies only an infinitesimal proportion of the Gupta gold coins, the great bulk of which have been obtained far to the east of that city.

## SECTION VI.

### *The Gupta Mint-Cities and Capital.*

In Southern India the ancient native governments permitted subordinate rulers and even private persons to coin in all metals, including gold, with little restriction, but there is no indication of similar laxity having at any time prevailed in Hindustan.\*

In Northern India successive dynasties followed, so far as is known, the practice of the Persian kings and Roman emperors, and jealously retained in their own hands the right of coining gold.

If this be admitted, it follows that the ancient gold coinages of Northern India will have been struck at or near the seats of government of the sovereigns who issued them. If, therefore, we can discover the position of the mint-cities where the gold pieces of the Gupta kings were

struck, we may feel confident that we have also discovered the site of the capital, or capitals, of those princes.

Prinsep designated the Gupta gold coinage by the name of the 'Kanauj series.' Almost without exception later writers on Indian archæology have followed him, and it seems to me, have rather blindly followed him, in assuming the existence of a special connection between the Gupta dynasty and Kanauj.

Not to mention other and less authoritative writers, Mr. Burgess speaks of "the Guptas of Kanauj,"\* and Sir E. C. Bayley does not hesitate to affirm explicitly that Kanauj was the Gupta capital†. But what evidence warrants us in asserting that the Gupta kings had their capital at Kanauj? I can find none.

It will not be disputed that the belief in Kanauj being the Gupta capital originated in Prinsep's designation of the gold coins as the 'Kanauj series,' and in his assertion that they were most commonly found at Kanauj. But the statistics given in the last preceding section of this paper, which are indisputable so far as they go, prove that Prinsep was mistaken as to the fact, and that the coins in question are *not* most commonly found at Kanauj. Attention has already been drawn to the circumstance that Prinsep subsequently corrected his earlier and less guarded assertion, and bracketed Jaunpur and Gayá with Kanauj, as the places where the Gupta gold coins were found in greatest abundance; and, from the first, he was careful to note that *no history connected the Guptas and Kanauj*. Prinsep's error, therefore, so far as it was an error, was not a grave one, and his statements offer a very slender foundation for the categorical assertion that Kanauj was the Gupta capital.

It seems to me that Prinsep's misapprehension on the subject can be very easily explained. The fine Retreating Lion coin of Chandra Gupta II was obtained by Lieut. Conolly at Kanauj; and the fact that the publication and study of this coin led to the decipherment of the rest of the series appears to have impressed Prinsep's imagination, and to have influenced him in giving the name of 'Kanauj Series' to this class of gold coins.

However this may be, the solid fact remains that out of 37 coins described by Prinsep, the find-spots of 25 are known more or less accurately, and of these latter only 3 can be traced to Kanauj. Nor have I been able to find a record of a single hoard of Gupta gold coins found at that city, and it need hardly be observed that the occurrence of hoards in certain places is more valuable as evidence for the purposes of the his-

\* \* Archæol. Survey of W. India, II, p. 80.

† Num. Chron. II, 3rd S. (1882) p. 158.



torian than the finding of isolated coins, which may have reached their resting places in any of a hundred different ways.

I think, therefore, that the evidence now presented fully warrants the assertion that *the find-spots of the Gupta gold coins in no way support the statement that Kanauj was the Gupta capital.*

I am not aware that evidence of any other kind has ever been adduced in support of that statement, which has been passed from one writer to another apparently without examination.\*

I do not deny that Kanauj was in existence during the rule of the Gupta kings, nor that it was included in their dominions. Little appears to be known about its early history, but it has always been reputed one of the most ancient of Indian cities, and we know that it was an important place in 400 A. D. when Fa Hian visited it, and it appears to have been known by name to the geographer Ptolemy about A. D. 140. It is also certain that it was the capital of the eastern dominions of the great Harsha Varddhana in A. D. 634, but all these facts in no wise prove it to have been the Gupta capital.\* I am quite willing to admit that Sir E. C. Bayley is right in calling Kanauj 'the Dehli of the Hindus,' if that title be restricted to the centuries between 600 A. D. and the Muhammadan conquest, but I can find no authority for the antedating of this claim to precedence.†

The conclusion arrived at so far is a purely negative one. I shall now consider whether any positive result as to the position of the mints and capital may be obtained from a study of the find-spots of the Gupta gold coins and other evidence.

It may safely be affirmed that the records of the localities, both where hoards and where individual coins were found, indicate unmistakably that the Gupta gold coinage was struck and chiefly current in territories far to the east of Kanauj, and that these territories may be roughly described as the Province of Benares, with some adjoining districts. It seems to me impossible to draw any other conclusion from the evidence which has been set forth in the section on find-spots.\*

\* These references are quoted from Genl. Cunningham's *Archæol. Rep.* I, 280. Sir E. C. Bayley informs me that in the Basle edition of Ptolemy (1533) the name which is supposed to mean Kanauj is written *Kanayōpa*.

† The phrase 'the Delhi of the Hindus' is quoted from a letter on this subject with which Sir E. C. Bayley favoured me. His theory about the supposed dates in the Gupta era on the mediæval coinage of Kābul (*Num. Chron.* 3rd Ser. Vol. II, pp. 128-166 and 291-294) is of very doubtful correctness, and even if it were proved, does not contribute to the solution of the question discussed in the text. I see no reason for supposing that the use of the Gupta era was connected with the sovereignty of Kanauj.

‡ The scanty evidence as to the *provenance* of the Gupta copper coins (*ante*

The districts around Benares are rich in remains of ancient cities, and at present it does not seem possible to fix on any one of these with certainty as the Gupta capital. Very probably there was more than one capital, even at one and the same time, in the same way as Mahoba, Khajuráho, and Kálinjar may be appropriately described as respectively the civil, religious, and military capitals of the Chandel kingdom in Bundelkhand during mediæval times.

If a choice must be made, I should be inclined to fix upon Pátaliputra (Patna) as the headquarters of the eastern dominions of the Gupta kings.\* It is a little east of the places where the gold coins have been most often found, but is sufficiently near those places to make it quite credible that it was the capital city and chief mint. It must be remembered that the ancient Pátaliputra has been almost entirely<sup>•</sup> carried away by the Ganges,† and that consequently treasure trove is naturally scarce in the city which is its modern representative. No argument is needed to show that in the time of the Mauryas Pátaliputra deserved to be called 'the Delhi of the Hindus.' It was still a city in the time of Fa-Hian (400 A. D.), but, when Hwen Thsang visited the spot in 632 A. D., the once splendid metropolis had been reduced to a squalid village.‡ The cause of its ruin is not known, but I would conjecture that the White Huns may have destroyed the famous city.

General Cunningham has pointed out that the account of another Chinese traveller indicates that Pátaliputra was still flourishing as the capital of a great kingdom between the years 222 and 280 A. D., and has conjectured that the king referred to by the Chinese author was Kumára Gupta Mahendra and that "the decline of Pátaliputra was due to the fall of the great Gupta dynasty and the consequent removal of the seat of government to another place."§ It will be admitted by all that

p. 153 note) appears, so far as it goes, to indicate that they were issued from the same mints as the gold coins. The silver coinage was evidently provincial.

\* Wilford long ago fixed on Patna as the Gupta capital, but in doing so was guided by a mistaken notion that Padmāvatī was an equivalent of Pátaliputra (*Wilson's Vishnu Purāṇa*, 4to. edn. p. 480, note 70). I find that the late Mr. Wilton Oldham also speaks of "the Gupta dynasty, the capital of which was in Magadha or Bihār, the city of Pátaliputra, or the modern Patna" (*Hist. and Stat. Memoir of the Gházīpur District. Part I. p. 38*). Ayodhya was probably one of the chief cities of the Guptas.

† Arch. Rep. VIII, pp. XII, and 24.

‡ McCrindle, *Ancient India*, p. 207, note.

§ Cunningham, Arch. Rep. XI, 153. An English rendering of Stanislas Julien's revised version of the Chinese text is given in the *Indian Antiquary*, Vol. IX (1880) p. 17. An earlier version will be found in J. A. S. B., Vol. VI. pp. 61-75. The Chinese author does not specify Pátaliputra by name, but it is probable that Pátali-

Pátaliputra, by reason of its ancient importance, must have been one of the chief cities in the Gupta dominions. We are not, however, altogether restricted to indirect inference for proof of this fact.

The inscription on the back of the Táwá cave at Udayagiri near Bhilsa records that the cave was made by one Sába, whose ancestral name was Virasena a poet, and a resident of Pátaliputra, who had come thither with his king, Chandra Gupta.\*

The broken inscription at Garhtwá near Allahabad, which appears to belong, like that in the Táwá cave, to the reign of Chandra Gupta II, mentions Pátaliputra at the end of the eleventh line, but the inscription is so mutilated that the context cannot be made out.†

The inscriptions which give the genealogy of the Gupta family inform us that Kumári Devi, the queen of Chandra Gupta I, was the daughter of Lichchhavi, an assertion which is fully confirmed by the legend 'Kumári Devi Lichchhavayah' on the gold coins. It is highly probable that the lapidary and numismatic record means that the queen belonged to the Lichchhavi family of Kshatriyas who resided at Vaisáli, and are famous for their devotion to the Buddha in earlier times. Vaisáli is the modern Besárh or Besádh, 27 miles distant from Patna, (*Cunn. Arch. Rep.* Vol. I, p. 55), and, if the identity of the Lichchhavi family in Buddhist and Gupta times be admitted, the alliance of the Gupta kings with that family is another indication that their capital was at or near Patna. I may note in passing that the alliance is also a proof that the Guptas were a Kshatriya family, and not either Súdras or foreigners. The narrative of I-tsing (*circa* 690-700 *A. D.*) shows that the dominions of Śrī Gupta, the founder of the dynasty, were situated in Magadha, and included Buddha Gaya. He says, "All parts of the world have their appropriate temples, except China, so that priests from that country have many hardships to endure. Eastward, about forty stages [*scil. yojanas*] following the course of the Ganges, we come to the Mrigasikavana Temple. Not far from this is a ruined establishment called the Tchina Temple. The old tradition says that formerly a Mahárāja called Śrī Gupta built this for the priests of China. At this time some Chinese priests, some twenty men or so came from Sz'chuan to the Mahábodhi Temple to pay worship to it, on which the king, seeing their piety, gave them as a gift this plot of land. The land now belongs to the king of Eastern India, whose name is Deva Varmma." (*J. R. A. S. Vol. XIII, N. S. pp. 571, 572*). This

putra was the city referred to. If that supposition be correct, Pátaliputra must have been the Gupta capital, at the period indicated, for at that period it was certainly under Gupta rule.

\* Cunningham, Arch. Rep. X, pp. 51, 52.

† Cunningham, Arch. Rep. III, 57.

passage appears to me to be strong evidence that the Gupta dynasty took its rise in Magadha, and that its capital was, consequently, in all probability, Pāṭaliputra, the leading city of Magadha.

The well-known passages in the Purāṇas, which mention the Gupta dynasty, also point to the fact that the centre of gravity of their empire lay east of Kanauj. The Vishṇu Purāṇa states that the Guptas of Magadha reigned "along the Ganges to Prayāga" (Allahabad), and the Vāyu Purāṇa (which is supposed to be more ancient) adds that, besides the regions so specified, Śāketa was included in their dominions.\* The expression "along the Ganges to Prayāga" evidently refers to the course of the river from Magadha (i. e., the country around Pāṭaliputra) on the east, to Prayāga on the west.

I was at one time inclined to suppose that the Paurāṇic texts referred to the later Guptas of Magadha mentioned in the Apsar inscription,† but I now prefer to accept the general opinion which interprets the texts as referring to the imperial dynasty. Mr. A. Grant's gold Gupta coins were all (except one) obtained in Oudh, and mostly in the neighbourhood of Śāketa (= Ayodhyā, near Faizābād), and Mr. Hooper's were likewise found in Eastern Oudh, which facts are some confirmation of the statement in the Vāyu Purāṇa, if referred to the earlier dynasty. There is, moreover, no proof that the small territory of the later Guptas extended so far west as Śāketa, which may have declined before their time, as in A. D. 400 the famous neighbouring city of Śrāvastī had descended to the rank of a petty village, and in A. D. 632 was completely deserted.‡

The distribution of the architectural and sculptural remains of the Gupta dynasty supplies another argument to prove that the capital of the dominions of the dynasty in Northern India lay further east than is commonly supposed.

If the remains in Central India and Guzerat be excluded, which mark the extent of the western conquests of the later members of the family,§ I think that the only records in stone of the Guptas yet discovered west of Allahabad are the broken inscription at Mathurā, which gives the genealogy of Samudra Gupta,|| and the dedicatory inscrip-

\* Wilson's Vishṇu Purāṇa (quarto edition), p. 479.

† Cunningham, Arch. Rep. III, 136, and XVI, p. 79. A dynasty, with the family name of Gupta, reigned in Orissa probably as late as the tenth century A. D. (*Ind. Antiquary*, Vol. V, pp. 55 seqq.)

‡ Cunningham, Arch. Rep. I, 333, referring to Fa-Hian and Hwen Thsang.

§ I concur with Prof. Oldenberg in regarding as a forgery the so-called Jūnagarh tradition published by Major Watson (*Ind. Ant.* II, 312).

|| Cunn. Arch. Rep. I, 237 and III, 36.

tions at Bilsar (20 miles N. E. of Etá) containing the genealogy of Kumára Gupta.\* A copper-plate grant dated in the reign of Skanda Gupta has been found at Indor Khera, eight miles S. S. W. of Anúpsahr.† This is a meagre list when compared with the catalogue of inscribed pillars and ruined edifices which are known to exist eastward. Allahabad (Pray ága) possesses the great inscription containing the history of Samudra Gupta, engraved after his death on the pillar set up by the great Maurya emperor of Pátaliputra,‡ and in the neighbourhood of Allahabad numerous ruins and inscriptions of the Gupta period are found at Kosambi (Kosam),§ Garhwá or Bhatgarh,|| and Bithá-Deoriyá.¶ Going further east, we find at Bhitari in the Gházipur district, between Benares and Gházipur, the celebrated inscribed pillar giving the history of Skanda Gupta, associated with the ruins of extensive brick buildings belonging to the reign of his predecessor Kumára.\*\* The uninscribed pillar at Zamániá in the same district appears to be of about the same date;†† and still further east, Bilár has pillars to show, which were inscribed in the reigns of Kumára and Skanda,‡‡ and in the Gorakhpur district, north of Gházipur, is to be seen the Jain pillar at Kahaon dedicated in the reign of Skanda Gupta.§§

The distribution of the architectural and sculptural remains, therefore, closely coincides with that of the gold and copper coins, and is equally adverse to the claim of Kanauj to the honour of having been the Gupta capital.

There is no reason to suppose that the sway of the Guptas extended over Lower Bengal, and it seems probable that the coins found in that province came there in the course of trade and travel, and mark the line of a trade route which led to Támralipti or some other ancient port at the mouths of the Ganges.||||

Sir E. C. Bayley has been good enough to favour me with his criticism on the views above enunciated, the outline of which was submitted

\* *Ibid.* XI, 17.

† *Ibid.* XII, 38.

‡ Prinsep's *Essays*, Vol. I, p. 233.

§ Cunningham *Arch. Rep.* X, 3 *seqq.*

|| *Ibid.*, III, 53 *seqq.* and X, 10, *seqq.*

¶ *Ibid.* III, 48 and X, 7, 8.

\*\* *Ibid.* I. 97 *seqq.*, etc. The second vowel in Bhitari is not long as it is generally marked.

†† *Ibid.* III, 62.

‡‡ *Ibid.* I, 36.

§§ The corrected facsimile and translation with notes are given in *Ind. Antiquary* for 1891, pp. 124-126.

|||| The Chinese account above referred to proves that the Indian capital in the middle of the third century A. D. was a place of active trade.

to him. He urges that "gold, which in old Indian times, was not the current circulation of *every day* transactions, would collect, not at seats of Government, but round centres of commerce, such as Allahabad, Benares, and Faizábád always have been, and they are also centres of pilgrimage, which attract much gold and silver.

"It is almost an infallible indication of the neighbourhood of a sovereign's capital when his coins of very *minute* value are found in large numbers. It is only in the markets of large towns or cities that such a coinage was of use in India, owing to the social habits of the country, but such cities rarely existed except at the head-quarters of Government. The minute coins of the Pathán kings abound within twenty miles of Delhi, but are very rare elsewhere. Their gold coins are as common elsewhere as at Delhi. The copper coins of the Guptas are so rare, however, that no deduction can be drawn from them."

These remarks show the importance of tracing the *provenance* of the Gupta copper coins, which, as already observed, do not appear to be so rare as Sir E. C. Bayley supposes.

His remark that such "markets of large towns or cities" as Allahabad, Benares, and Faizábád were in the Gupta period, "rarely existed except at the head-quarters of Government" appears to me to lend much support to the inference which I have drawn from the recorded find-spots of the Gupta coins, especially the large hoards. However, the reader has now both views before him, and can judge for himself.

## SECTION VII.

### CONCLUSION.

I must now bring to a close this long but imperfect introductory essay, and invite the patient reader to enter upon the dry details of the Catalogue. My general description of the Gupta gold coins is specially deficient in two respects, namely, in omitting all systematic discussion of the fabric and of the palæography of the coins.

The details occasionally given in the Catalogue are sufficient to indicate that the standard of purity of metal was not always uniform, but I have not had an opportunity for procuring analyses of any of the coins, and must content myself with remarking that this subject should not be overlooked.

Circumstances have not permitted me to study the original coins sufficiently at leisure in order to work out the palæography of the legends, but I am convinced that the detailed study of this subject would not be barren of result. The alphabetical characters on the coins do not vary very much, but the variations are sufficient to deserve attention and

investigation.\* It seems to me that in the voluminous discussions respecting the date of the Guptas sufficient stress has not been laid on the palæography of their lapidary and numismatic inscriptions. A good book on the Elements of the Palæography of Northern India is badly wanted.

A minute study of the epigraphy of the coins might perhaps lead to a more satisfactory chronological arrangement of the several types of each reign than I have been able to make. The types are arranged in my Catalogue in an order which seemed to be not inconsistent with chronological succession, but the arrangement does not profess to be satisfactory, and in many respects is arbitrary, and open to correction.

The materials used in the compilation of my Catalogue are detailed below :—

I. PUBLISHED COINS, viz. :—

1. Col. Tod's paper in *Trans. Roy. As. Soc.* (1827), Vol. I. p. 340, and Pl. XII, 4th series.†
2. H. H. Wilson's paper in *Asiatic Researches*, Vol. XVII, and Pl. I.‡
3. Marsden's *Numismata Orientalia*, Nos. ML-MLIX inclusive.§
4. Wilson's *Ariana Antiqua*, Pl. XVIII.||

\* Some desultory observations concerning the palæography of the Gupta coins generally will be found in Mr. Thomas's essay on the Coins of the Gupta Dynasty (*J. A. S. B.* XXIV, pp. 491, 505, 510; 512 and 517), and concerning that of the silver coins in Cunningham's *Arch. Rep.* IX, 21-26. In one corner of India, the Punjáb hills between the Indus and the Jumna, the Gupta alphabet has never been changed, and "the Baniyas of the hills still keep their accounts in Gupta characters." (*Cunn. Arch. Rep.* XIV, p. 121). This very remarkable fact should be borne in mind by all palæographers.

† Fig. 1, Kumára Gupta Mahendra (Archer, class I  $\alpha$ ); fig. 2, Chandra Gupta II (Archer, class II  $\alpha$ ); fig. 3, Chandra Gupta II, (Lion-Trampler, var.  $\alpha$ ); fig. 4, ditto (ditto, var.  $\gamma$ ).

‡ Fig. 5, Samudra Gupta (Javelin, var. 1); fig. 7, ditto (ditto, var. 2); fig. 12, Skanda Gupta (King and Queen, = P. E. XXIII, 24); fig. 13, Chandra Gupta II (Archer, class II  $\alpha$ ); fig. 17, Prakásáditya. (Lion and Horseman); fig. 18, Kumára Gupta Mahendra (Horseman to Left); fig. 19, Samudra Gupta, (Lyrist).

§ ML, Chandra Gupta II (Archer, class II  $\alpha$ ); MLI and MLVI, Chandra Gupta? (Archer, barbarous); MLII and MLIII, Kumára Gupta? (Archer, barbarous); MLIV, Nára Gupta, (Archer, barbarous); MLV, Skanda Gupta?, (Archer, barbarous); MLVII, Chandra Gupta II (Archer, class I  $\beta$ ); MLVIII, Chandra Gupta I (King and Queen); MLIX, Kumára Gupta Mahendra, (Horseman to Right, var.  $\gamma$ ).

|| Fig. 1, Chandra Gupta II, (Swordsman and Umbrella); fig. 2, Samudra Gupta (Aśwamedha); fig. 3, Chandra Gupta I, (King and Queen); fig. 4, Chandra Gupta II (Archer, class II); fig. 5, Chandra Gupta II, (Lion-Trampler, var.  $\alpha$ );

5. Memo. on ancient gold coins found at Bharsar, near Benares; by Major Kittoe and Mr. E. C. Bayley; 32 coins described. (*J. A. S. B. XXI* (1852) pp. 390-400 and *Pl. XII*, figs 1-9.)

6. Prinsep's Essays and Plates. The plates of Gupta gold coins in Thomas's edition are,

|           |                   |                 |              |
|-----------|-------------------|-----------------|--------------|
| Pl. XXII, | figs. 16 and 17 = | J. A. S. B. IV, | Pl. XXXVIII. |
| „ XXIII,  | „ 18 to 32 =      | „ „ „           | XXXIX.       |
| „ XXIX,   | „ 11 „ 20 =       | „ V,            | „ XXXVI.     |
| „ XXX,    | „ 1 „ 10 =        | „ „ „           | XXXVIII.     |

(The engravings of Gupta gold coins in *J. R. A. S. Vol. XII, O. S.* (1850) are reproductions of Prinsep's plates, and Plates X and XI of H. T. Prinsep's Note on the Historical discoveries deducible from the Recent discoveries in Afghanistan (*Lond.* 1844) are equivalent respectively to *Pls. XXII and XXIX* in Thomas's edition of Prinsep's Essays.)

7. E. Thomas's original Catalogue of Gupta Gold Coins in *J. A. S. B. XXIV* (1855), pp. 487-502.

8. E. Thomas's Revised Catalogue of Gupta Gold Coins in his edition of Prinsep's Essays, (1858), Vol. I, pp. 377-387.

9. E. Thomas's Records of the Gupta Dynasty, (*Trübner*, 1876), pp. 21-24, and Autotype Pl. figs 1-5. (This work is a reprint of Chapter III in Burgess' *Archæol. Rep. for Western India*, for the year 1874-5).

10. Sundry miscellaneous notices, as cited in the Catalogue.\*

II. BRITISH MUSEUM COLLECTION.†

III. INDIA OFFICE COLLECTION, NOW IN B. M.†

IV. CABINET OF SIR E. C. BAYLEY, K. C. S. I., and other coins communicated by him.‡

figs. 6 and 9, Samudra Gupta (*Javelin*, var. 1); figs. 7 and 8, ditto, (*Archer*, var. *a*); fig. 10, ditto, (*Boy and Battle-axe*, var. *γ*); fig. 11, Kumāra Gupta Mahendra, (*Archer*, class II); fig. 12, ditto, (ditto, class I *a*); fig. 13, ditto (*Peacock* var. *a*); fig. 14, Ghaṭot Kacha, (*Solar Standard*); [fig. 15, Chandra Gupta II, copper]; fig. 16, Kumāra Gupta Mahendra, (*Horseman to Right*, var. *a*); fig. 17, Chandra Gupta II, (*Lancer*, var. *β*); figs. 18 and 19, Prakāśāditya, (*Lion and Horseman*); fig. 20, "of doubtful authenticity"; fig. 21, Chandra Gupta?, (*Archer*, barbarous); fig. 22, Nāra Gupta (*Archer*, barbarous); fig. 23, Kumāra Gupta? (ditto, ditto); fig. 24, Vishnu Gupta (ditto, ditto); figs. 25-28, rude mediæval imitations of Gupta type.

\* I believe that I have seen all descriptions of Gupta gold coins in English publications, but, if any should have escaped my notice, I hope that some critic will rectify the omission. I am not aware of any foreign publications on the subject.

† I am very specially indebted to Prof. Percy Gardner for the trouble he took in weighing for me all the specimens in the British Museum and India Office collections, and for much kind assistance in other ways. My acknowledgments are also due to Mr. R. S. Poole and the other officials in the Coin Room of the British Museum for their courteous aid.

‡ Sir E. C. Bayley generously lent me his coins for examination, and has



- V. CABINET OF A. GRANT, Esq.,\* C. I. E.
- VI. CABINET OF W. THEOBALD, Esq.†
- VII. COLLECTION OF THE ASIATIC SOCIETY OF BENGAL.‡
- VIII. THE HUGLI HOARD.
- IX. CABINET OF MAJOR-GENERAL CUNNINGHAM, C. S. I., Director Genl. of the Archæological Survey of India.§
- X. Bodleian collection.||
- XI. Cabinet of J. Hooper, Esq., B. C. S.¶
- XII. Cabinet of H. Rivett-Carnac, Esq., C. S., C. I. E.

favoured me with several valuable communications. While these sheets are passing through the press the melancholy news of his death has reached me.

\* Mr. A. Grant, C. I. E. was also good enough to lend me his valuable collection of Gupta gold coins, and to give me all the information he could on the subject.

† Mr. W. Theobald has kindly favoured me with full particulars of the specimens in his possession.

‡ I am indebted to Dr. Hoernle for a list of the Gupta gold coins in the cabinet of the A. S. B., and of those comprised in the Huglí hoard.

§ General Cunningham has favoured me with a rough list of the Gupta gold and silver coins in his cabinet, and with sundry valuable notes.

|| Mr. W. S. W. Vaux, F. R. S. has kindly given me information about some of the Gupta coins in the Bodleian collection.

¶ Mr. Hooper has been good enough to let me examine his coins.

TABLE OF WEIGHTS.\*

| Reign.            | Type.               | Variety.       | Number of Coins weighed. | Lowest weight. | Highest weight. | Average weight. | Remarks.                                 |
|-------------------|---------------------|----------------|--------------------------|----------------|-----------------|-----------------|------------------------------------------|
| Ghatot Kacha.     | Solar standard      | .....          | 4                        | 111·0          | 118·0           | 114·95          |                                          |
| Chandra Gupta I.  | King & Queen        | .....          | 4                        | 113·0          | 123·8           | 117·57          |                                          |
| Samudra Gupta.    | Javelin             | 1. Genl. type. | 12                       | 113·4          | 118·6           | 115·85          | Excluding W. T., 106, and I. O., 108·2.  |
| "                 | "                   | 2.             | ...                      | ...            | ...             | ...             |                                          |
| "                 | "                   | 3.             | 1                        | ...            | ...             | 119·2           |                                          |
| "                 | "                   | 4.             | 2                        | 114·0          | 119·3           | 116·65          |                                          |
| "                 | Archer.             | 1. Apratiratha | 5                        | 117·1          | 120·0           | 118·34          |                                          |
| "                 | "                   | 2. Parákrama   | 3                        | 110·0          | 114·0           | 111·33          |                                          |
| "                 | Lyríst.             | .....          | 5                        | 111·0          | 122·0           | 118·12          |                                          |
| "                 | Aśwamedha.          | .....          | 6                        | 113·2          | 117·7           | 116·18          |                                          |
| "                 | Tiger.              | .....          | 1                        | ...            | ...             | 116·6           | Unique.                                  |
| "                 | Boy and Battle-axe. | .....          | 4                        | 116·7          | 123·4           | 118·7           | All varieties; viz., 3 of α, and 1 of β. |
| Chandra Gupta II. | Couch.              | .....          | 1                        | ...            | ...             | 114·7           | Unique.                                  |
| "                 | Archer.             | Class I, α.    | 1                        | ...            | ...             | 113·2           |                                          |
| "                 | "                   | " β.           | 2                        | 118·0          | 120·9           | 119·45          |                                          |
| "                 | "                   | Class II, α.   | 17                       | 119·2          | 127·6           | 123·04          | Excluding No. 5 Bharsar, 112·0.          |
| "                 | "                   | " β.           | 8                        | 126·6          | 132·5           | 129·77          |                                          |
| "                 | "                   | " γ.           | 2                        | 126·0          | 126·0           | 126·0           |                                          |
| "                 | "                   | " δ.           | 2                        | 112·0          | 118·4           | 115·2           |                                          |
| "                 | "                   | " ε.           | 1                        | ...            | ...             | 122·3           |                                          |
| "                 | Lancer.             | " α            | 2                        | 118·6          | 119·7           | 119·15          |                                          |
| "                 | "                   | " β            | ...                      | ...            | ...             | ...             |                                          |
| "                 | Horsoman to Left.   | .....          | 3                        | 122·0          | 124·0           | 122·66          |                                          |
| "                 | Lion-Trampler       | α              | 2 }                      | 115·4          | 122·0           | 118·52          |                                          |
| "                 | "                   | β              | 1 }                      | ...            | ...             | ...             |                                          |
| "                 | "                   | γ              | ...                      | ...            | ...             | ...             |                                          |
| "                 | "                   | δ              | ...                      | ...            | ...             | ...             |                                          |

\* The weights of twelve coins belonging to Mr. H. Rivett-Carnac, C. I. E. were received too late for insertion in the Table. They are as follows:—

|                   |                     |                      |
|-------------------|---------------------|----------------------|
| Chandra Gupta I.  | King and Queen type | ; 119·00 and 119·50. |
| Samudra Gupta.    | Javelin             | ; 117·65.            |
| "                 | Aśwamedha           | ; 117·00.            |
| Chandra Gupta II. | Archer              | " (Class I); 118·90. |
| "                 | "                   | " ( " II); 118·60.   |
| "                 | Lion-Trampler       | ; 120·45 and 122·00. |
| "                 | Combatant Lion      | ; 118·60.            |
| Kumára Gupta      |                     |                      |

|           |         |                      |
|-----------|---------|----------------------|
| Mahendra. | Archer  | ; 126·75.            |
| "         | Peacock | ; 127·50 and 127·60. |

The weight of the unique coin of Kumára Gupta Mahendra of the Two Queens type is not stated.

| Reign.                 | Type.                 | Variety.          | Number of Coins<br>weighed. | Lowest weight. | Highest weight. | Average weight. | Remarks.                                    |
|------------------------|-----------------------|-------------------|-----------------------------|----------------|-----------------|-----------------|---------------------------------------------|
| Chandra Gupta II.      | Combatant Lion.       | .....             | 3                           | 111·4          | 120·9           | 116·56          |                                             |
| "                      | Retreating Lion.      | .....             | 1                           | ...            | ...             | 123·0           | Unique.                                     |
| "                      | Swordsman & Umbrella. | .....             | 4                           | 117·5          | 121·0           | 119·7           |                                             |
| Kumára Gupta Mahendra. | Swordsman             | .....             | 1                           | ...            | ...             | 124·2           | Unique.                                     |
| "                      | Archer.               | Class I, a.       | 3                           | 123            | 124·7           | 124·06          | Excluding B. M. Prinsep, worn, weight 106·7 |
| "                      | "                     | " β.              | ...                         | ...            | ...             | ...             |                                             |
| "                      | "                     | " γ.              | 1                           | ...            | ...             | 125·0           |                                             |
| "                      | "                     | " δ.              | 1                           | ...            | ...             | 125·0           |                                             |
| "                      | "                     | " ε.              | 1                           | ...            | ...             | 126·0           |                                             |
| "                      | "                     | " ζ.              | ...                         | ...            | ...             | ...             | Av. of class, 6 coins, 124·7.               |
| "                      | "                     | Class II.         | 3                           | 119·5          | 123·5           | 121·46          |                                             |
| "                      | Horseman to Right.    | a.                | 2                           | 124·5          | 125·0           | 124·75          |                                             |
| "                      | "                     | β.                | 1                           | ...            | ...             | 126·5           |                                             |
| "                      | "                     | γ.                | 11                          | 124·0          | 127·2           | 125·3           | B. M., E. T., worn, wt. 117·3, excluded.    |
| "                      | Horseman to Left.     | .....             | 5                           | 123·2          | 126·0           | 124·2           |                                             |
| "                      | Peacock.              | a.                | 3                           | 126·5          | 128·6           | 127·83          |                                             |
| "                      | "                     | β.                | 5                           | 124·0          | 128·2           | 126·72          |                                             |
| "                      | Lion-Trampler         | a.                | ...                         | ...            | ...             | ...             |                                             |
| "                      | "                     | β.                | 1                           | ...            | ...             | 127·2           |                                             |
| "                      | Combatant Lion.       | ...               | 2                           | 124·5          | 126·1           | 125·3           |                                             |
| Skanda Gupta.          | Archer.               | Srī Skanda Gupta. | 9                           | 125·0          | 132·5           | 129·21          |                                             |
| "                      | King & Queen.         | ...               | 1                           | ...            | ...             | 128·8           |                                             |

## SUPPLEMENT.

|                            |                    |             |       |       |        |                                       |
|----------------------------|--------------------|-------------|-------|-------|--------|---------------------------------------|
| Chandra Gupta (barbarous). | Archer.            |             | 144·5 | 148   | 145·66 |                                       |
| Kumára Gupta (ditto).      |                    |             | 143   | 148·7 | 146·3  |                                       |
| Skanda Gupta (ditto).      |                    | Kramáditya. |       |       | 141·4  |                                       |
| Nāra Gupta.                |                    |             | 143·5 | 148·7 | 145·66 |                                       |
| Prakásāditya.              | Lion and Horseman. |             | 145·0 | 146·2 | 145·6  | Excluding B. M. Pringle, worn, 136·0. |
| Grand Total,...            |                    |             | 165   | 110   | 148·7  |                                       |

## CLASSIFIED AND DETAILED CATALOGUE.

## ABBREVIATIONS.

|             |     |     |                                                                                |
|-------------|-----|-----|--------------------------------------------------------------------------------|
| A. A.       | ... | ... | Wilson's <i>Ariana Antiqua</i> .                                               |
| A. C.       | ... | ... | Cabinet of Major Gen. Cunningham, C.S.I.;<br>C. I. E.                          |
| A. G.       | ... | ... | Cabinet of Alexander Grant, Esq., C. I. E.*                                    |
| A. S. B.    | ... | ... | Asiatic Society of Bengal.                                                     |
| As. Res.    | ... | ... | Asiatic Researches.                                                            |
| B.          | ... | ... | Bodleian collection.                                                           |
| B. M.       | ... | ... | British Museum collection.                                                     |
| C.          | ... | ... | Cabinet of H. Rivett-Carnac, Esq., C.S., C.I.E.                                |
| E. C. B.    | ... | ... | Cabinet of the late Sir E. C. Bayley, K.C.S.I.                                 |
| H.          | ... | ... | „ „, J. Hooper, Esq., B. C. S.                                                 |
| I. O.       | ... | ... | India Office collection (now in B. M.)                                         |
| J. A. S. B. | ... | ... | Journal of Asiatic Society of Bengal.                                          |
| J. R. A. S. | ... | ... | Journal of Royal Asiatic Society.                                              |
| l.          | ... | ... | Left (of reader).                                                              |
| Marsden.    | ... | ... | Marsden's <i>Numismata Orientalia</i> .                                        |
| Mon.        | ... | ... | Monogram.                                                                      |
| P. E.       | ... | ... | Prinsep's <i>Essays</i> , ed. Thomas.                                          |
| r.          | ... | ... | Right (of reader).                                                             |
| Records.    | ... | ... | Records of Gupta Dynasty (Thomas, 1876).                                       |
| Rev. Catal. | ... | ... | Thomas' Revised Catalogue of Gupta Gold<br>Coins in P. E. Vol. I, pp. 377-387. |
| Wt.         | ... | ... | Weight in English grains.                                                      |
| W. T.       | ... | ... | Cabinet of W. Theobald, Esq.                                                   |

## GHATOT KACHA.

## SOLAR STANDARD TYPE.

(*J. A. S. B.* XXIV, pp. 487-491, class A; *Rev. Catal.* class 4.,)

*Obv.* King, standing, with head to l.; he wears close cap, tailed coat, and leggings, of Indo-Scythian style with some modification; his l. hand either grasps, or extends across, a standard bearing a symbol of the rayed sun; his r. hand casts incense on a small altar. Under l. arm क कचा, 'Kacha,' which is sometimes read as क 'Kácha.'

\* Mr. A. Grant's Gupta gold coins are now in the Ermitage Impérial at St. Petersburg, the Director of which institution, M. Tiesenhausen, obligingly supplied me with impressions of the coins.

Marginal legend, as restored by Thomas, is कामभिषत्तमैजय  
 कचोऽयमवजत्य इ [or क्ष], which, after needful corrections, is  
 rendered 'Kacha, having subdued the earth, secures victory  
 by excellent deeds'; but *quare?* Prinsep read काम नवत्तम  
 जय, and interpreted 'Kacha, son of an excellent man resem-  
 bling Kāma', 'Gha'—standing for 'Ghaṭot.'

*Rev.* Goddess, standing to l., holding lotus-flower in r. hand, and  
 grasping cornucopia in l. arm. Legend in r. field distinct  
 सवराजोद्धेत, 'exterminator of all rājās.' Mon.\*

*References and Remarks.* P. E. XXIX, 12; mon. 1; wt. not stated; legend described as be-  
 ing in the "most unequivocal and well-formed  
 Nāgarī"; from Tregear collection.

B. M. Prinsep; mon. 2; wt. 115.2; the B. M. label may be wrong,  
 for Thomas (*J. A. S. B.* XXIV, p. 491) ascribes  
 mon. 2 to a coin in Freeling collection. (*Pl. I.*  
*fig. 1.*)

A. A. XVIII, 4; mon. 4a; wt. not stated. This figure purports to  
 be a copy of P. E. XXIX, 12, but there is some  
 mistake, for the mons. differ. Pennons attached  
 to shaft of standard. *Obv.* marginal legend mis-  
 read by Wilson.

B. M., Edon, two specimens; mon. in both 4a, as in A. A. XVIII,  
 4; wts. 111 and 115.6 respectively. The latter coin  
 is figured in Records, autotype Pl. fig. 1, and de-  
 scribed *ibid.*, p. 21, where the wt. is stated to be 116.

W. T.; mon. imperfect; wt. 118.

A. S. B.; one specimen, no details stated.

B. ditto, ditto.

A. C.; three specimens, no details stated.

Mr. Thomas (*J. A. S. B.* XXIV, p. 490) notes the existence of a  
 specimen in the Stacy collection, and another in the Bush cabinet, both  
 with the same mon. as A. A. XVIII, 4. He observes that the letter *m*  
 in the Freeling and Tregear coins is of more ancient form than that in  
 the Stacy, Bush, and A. A. specimens, in which latter the form of the  
 letter resembles that used in the Gupta lapidary inscriptions.

The epithet 'exterminator of all rājās' occurs in the Bhitari Pillar  
 inscription.

A solar standard "exactly similar" to that on these gold coins is  
 inserted below the middle of the Tushām inscription, which is supposed  
 to record the conquest of Ghaṭot Kacha by the Tushāra king Vishṇu, but

\* Throughout the series the *obv.* king and *rev.* goddess have almost always a  
 nimbus round the head, and the *rev.* margin is generally surrounded by a more or  
 less perfect dotted circle. I have not thought it necessary to note these items in  
 the detailed descriptions.

unfortunately the published translation of that inscription is not to be depended on. (*See Cunningham, Arch. Rep. V, p. 140, Pl. XL.*)

# CHANDRA GUPTA I.

## KING AND QUEEN TYPE.

(*J. A. S. B. XXIV, p. 493, class B; Rev. Catal. class C.*)

*Obv.* King, wearing tailed coat and close-fitting cap, standing to l., facing queen, who looks to r. King's l. arm resting on spear, his r. hand raised.

Under king's l. arm च गु 'Chandra Gupta or च 'Chandra.'

Behind queen कुमारी देवी श्री, 'Kumári Deví Śrī.'

*Rev.* Goddess, holding fillet in r. hand, and cornucopia in l. arm, seated on couchant lion, which faces r., except in two coins. Legend in field to r., लिच्छवयः, 'Lichchhavayah.' Mon.

*References* Marsden MLVIII. B. M. brought from India by Lord Valentine (Mountmorris); mon. 5, wt. 115.3.

*and*

*Remarks.*

Under king's arms च गु 'Chandra Gupta.'

Condition inferior, and Queen's name illegible. In Marsden's text *rev.* lion erroneously described as 'a throne'.

P. E. Vol. I, p. 369, Pl. XXIX, 15. Under king's arms

'Chandra Gupta.' Queen's name illegible; mon. 8d; wt. not stated. The coin figured was in Stacy collection, and a duplicate in Tregear's.

B. M., purchased from a dealer in 1878. Under king's arm च गु

'Chandra Gupta'; diameter 8; mon. 3a; wt. 123.8; condition very fine, and queen's name plainly legible. (*Pl. I fig. 2.*)

A. A. XVIII. 3; B. M., Swinoy; under king's arm च 'Chandra'

spear tipped with crescent; queen's name mostly legible; diameter .8; mon. 4b; wt. 118.2.

W. T.; *rev.* lion facing l.; mon. 22b; wt. 113; bought at Benares. B.; *rev.* lion to l.; king raises open hand in front of queen's face.

C.; two specimens, *viz.*, one obtained at Gházipur, wt. 119; and one obtained at Benares, wt. 119.5.

Queen's name and *rev.* legend read correctly for first time by Cunningham (*Arch. Rep., Vol. I, Introd. p. xxiv*), who possesses three coins of this type, in two of which the legends are distinct.

The attribution of this type is certain, because we know from the Bhitari and Bilsar Pillar inscriptions that Kumāri Devī was the queen of Chandra Gupta I, whereas the consort of Chandra Gupta II was named Dhruvā Devī. No other type of the coinage of Chandra Gupta I, is known. The Swordsman and Umbrella coins are sometimes attributed to him, but should, almost certainly, be assigned to Chandra Gupta II.

The late Sir E. C. Bayley possessed two coins of Indo-Scythian style, which, in his opinion, may possibly have been struck by Chandra Gupta I (wt. 120·3, and 118·3). The name under the king's arm is doubtfully read as 'Chandra.'

The B. M. collection contains two coins, which are nearly, though not quite, identical with Sir E. C. Bayley's. The B. M. coins have a legend behind the spear, which is wanting in the others. I give a figure of one of the B. M. specimens, wt. 119·2 (*Pl. IV, fig. 6*) to illustrate the style, and for comparison with the undoubted Gupta series. Mr. Thomas reads the name under the king's arm on the coin figured as either 'Chandra' or 'Bhadri,' and the legend behind the spear as 'Shanḍhi,' a Scythian tribal name. (*Cf. Indo-Scythian Coins with Hindi Legends, Nos. 10 and 11*) Sir E. C. Bayley concurred with Mr. Thomas in classing this piece as Indo-Scythian, and believed that it was minted by one of the Indo-Scythian princes in the Punjab, contemporary with the earlier Gupta kings. The specimens in Sir E. C. Bayley's cabinet, above referred to, resemble the coin figured so closely in style, in spite of the want of legend behind the spear, that I do not think they can be attributed to Chandra Gupta I. They seem to me to belong to the same class as the 'Shanḍhi' coin.

### SAMUDRA GUPTA.

#### JAVELIN TYPE.

(*J. A. S. B. XXIV, pp. 493-495, class C; Rev. Catal., D, 2 D, and 3 D.*)

*Obv.* King standing, generally to l., dressed nearly same as king in coins of Ghatot Kacha, casting incense with r. hand on small altar in l. field, and leaning with l. arm on spear or javelin; behind r. arm the bird standard.

Under l. arm स मु 'Samudra', or in var. 4, स ग मु 'Samudra

Gupta.' In var. 2, king to r., with javelin in r. hand, name under r. arm. Legend (as restored by Thomas, but in parts doubtful) समरघ्नत वततवजयजितरेपरद्वज, which, when corrected into grammatical Sanskrit, is rendered 'Overcoming hostile kings in triumphant victory (over those) opposing in a hundred battles.' This legend follows margin, except in var. 3.

*Rev* In all var.; goddess, facing front, seated on raised throne with four lathe-turned legs, her feet resting on a footstool, r. hand holding fillet, l. arm grasping cornucopia. Legend, near r. margin, पराक्रमी, 'the hero.' Mon.

*References and* Var. 1, general type, as described above, (class D. of *Rev. Catal.*)

*Remarks.* A. A. XVIII, 6; mon. 3a; wt. not stated; perhaps same as B. M. coin without label, and with same mon.; wt. 117.8.

*ib. ib.*, 9; mon. 20a; wt. not stated; perhaps same as B. M. Twisden coin with same mon.; wt. 117.4.

As. Res. XVII, Pl. I, 7; engraved from a drawing; mon. 3a; wt. not stated.

P. E. XXII, 16; from Gen. Ventura's coll.; mon. 9; wt. not stated.

*ib.*, *ib.*, 17; from cabinet of Col. Smith of Patna; seems to be the B. M. Prinsep coin, with mon. 3a; wt. 114.

*ib.* XXIX, 14; found at Gayá; mon. 20b; wt. not stated.

B. M. Prinsep; mon. 8a; wt. 117.8. (*Plate II, fig. 3.*)

A. G.; mon. 8a nearly; wt. 114.5; *obv.* legend ..... राजसमर शत [च]; from Oudh.

*ibid*; mon. 4b; wt. 116.5; *obv.* legend [श] तवतविजयज; from Oudh; in fine condition.

W. T.; mon. 6b; wt. 114; of pale gold; bought at Mathurá.

*ibid*; mon. indistinct; wt. 106.

A. S. B.; two specimens; wts. not stated; mon. of one is 19a. Húgli hoard one specimen: no details stated.

I. O., No. 1 mon. 3a; wt. 114.4; in poor condition.

*ib.* No. 2 mon. 3a; wt. 108.2; ditto.

*ib.* No. 3 mon. 4c; wt. 113.4; ditto.

*ib.* No. 4 ditto, ditto; wt. 114.8; ditto.

*ib.* No. 5 mon. 22; wt. 118.6; ditto.

Bharsar hoard No. 4 of Samudra; mon. 3a; wt. 117; "a small dumpy coin, gold pale." (*J. A. S. B. XXI, 396.*)

A. C.; 4 specimens, apparently of this variety, but details are wanting.

B.; one specimen.

H.; two specimens, part of considerable find from ancient mound on the Rapti river in pargana Utraula of Gonda district in Oudh. Mr. H. S. Boys, C. S. also has a specimen from the same find.

Var. 2; king to r., javelin in r. hand, name under r. arm.

As. Res. XVII, Pl. I, 5; mon. imperfect; wt. not stated.

Var. 3; king to l., *obv.* legend parallel to javelin (class 2 D of *Rev. Catal.*).

B. M., Eden; *obv.* legend ? तवविजयोजितरे; mon. 4c; wt. 119.2 (*Pl. II, fig. 4*); in fine condition.

च

Var. 4; name on both sides of javelin म



B. M., Bush ; mon. 4c ; wt. 119.3 ; in fine condition (*Plate II, fig. 5*).  
 Bharsar hoard, No. 5 of Samudra ; mon. 3a ; wt. 114 (*J. A. S. B. XXI, 396*).

A. C. ; one specimen, no details stated.

C. ; obtained at Mathura ; wt. 117.65.

## SAMUDRA GUPTA.

### ARCHER TYPE.

(*J. A. S. B. XXIV, 496, class C ; Rev. Catal., class E.*)

*Obv.* King standing to l. arm resting on bow, and r. hand either holding arrow (var.  $\alpha$ ), or offering incense on altar (var.  $\beta$ ). Bird-standard adorned with pennons behind r. arm ; marginal legend imperfect ; see details below ; under l. arm

स  
मु  
द्र  
Samudra.

*Rev.* Throned goddess with fillet and cornucopia, as in Javelin type. Legend in var.  $\alpha$  is अक्षतिरयः, 'invincible in his war-chariot,' and in var.  $\beta$  is पराक्रमः, 'the hero,' as in Javelin type. Mon.

- References and Remarks.* Var.  $\alpha$  ; no altar on obv. ; rev. legend अक्षतिरयः  
 A. A. XVIII, 7 ; from Swiney coll. ; mon. 19a ; wt. not stated.  
 ib., ib., 8 ; in I. O. ; mon. 22, irregular ; wt. 120.  
 P. E. XXIII, 19 ; in B. M. ; dug up at Jaunpur by Tregear along with Chandra Gupta the Second's coin of Archer type, class 1  $\alpha$  ; mon. 21, irregular ; wt. 117.4.  
 B. M. Eden ; mon. 4c ; wt. 118 ; in fine condition ; *obv.* legend [वत] वज्र य त्ः [श्] अक्षतिरय वज्रयजितिसव (*Plate II, fig. 6.*)  
 A. G. ; mon. indistinct ; wt. 117.1 ; *obv.* legend ... तद्वजयत as in I. O. coin ; from Oudh.  
 ibid ; mon. indistinct ; wt. 119.2 ; *obv.* legend on l. margin ... वजयत, and on r. margin जत्य [क्षिति] सव [or त] ; from Oudh.  
 A. C. ; 1 specimen, no details stated.  
 B. ; ditto , ditto.  
 Var.  $\beta$  ; altar on obv. ; rev. legend पराक्रमः  
 Bharsar hoard, Nos. 1 and 3 of Samudra, with duplicate of No. 1 ; wt. of Nos. 1 and 3, 110 each ; wt. of duplicate 114. Apparently no marginal *obv.* legend on No. 1 ; that of No. 3 "very imperfect;" the gold of No. 3 "pale and alloyed." (*J. A. S. B. XXI, pp. 395, 396, 400.*)

## SAMUDRA GUPTA.

## LYRIST TYPE.

(J. A. S. B. XXIV, 498, class D ; Rev. Catal., class G.)

*Obv.* King, wearing close cap and tight drawers, to front, with head turned to l. seated on high-backed couch, over edge of which his feet are dangling. He is playing an Indian lyre (*viná*), which rests on his lap.

On footstool *वे* 'Se,' as under horse in *Aśwamedha*-type.

Marginal legend *महाराजभिराज श्री समुद्र गुप्तः*, 'the supreme king of kings, Samudra Gupta.'

*Rev.* Female figure, turned to l. seated on Indian wicker stool (*morhá*), holding in r. hand fillet, and in l. cornucopia. Between figure and legend a vertical line or mace.

Legend *समुद्र गुप्तः* 'Samudra Gupta.'

Mon. sometimes wanting.

*References and Remarks.* P. E. XXIII, 26. From Stacy coll.; no mon.; wt. not stated; is probably the B. M. Prinsep coin, wt. 119.5, which is a fine broad, thin coin; design in very low relief. A similar coin in fine condition in A. G. coll.; wt. 117.4, procured in Oudh.

B. M. Eden. Broad coin, in good condition as last; on *obv.* king's name is written *समुद्र* 'Sarmudra'; no mon.; wt. 111. (*Plate II, fig. 7.*) There is also a specimen of this variety in A. S. B.; wt. not stated.

I. O. Coin of smaller diameter, and thicker; *obv.* legend imperfect; *rev.* legend as usual; mon. 11; wt. 120.7. (*Plate II, fig. 8.*)

As. Res. XVII, Pl. I, 19. From a drawing of a coin said to belong to Mrs. White of Fatehgarh; seems to be a duplicate of P. E. XXIII, 26; no mon.; wt. not stated. Wilson mistook the lyre for a pillow.

No. 2 of Samudra from Bharsar hoard; *obv.* legend mostly illegible; "a fine specimen and in high relief;" mon. 8a; wt. 122. (J. A. S. B. XXI, pp. 392, 396, and *Plate XII, 5.* The description is not quite accurate, and the engraving is very bad.)

A. C.; 3 specimens, no details stated.

H.; 1 specimen from pargana Nawabganj in Gonda district opposite Ayodhya.

## SAMUDRA GUPTA.

## AŚWAMEDHA TYPE.

(J. A. S. B. XXIV, 498, class E; Rev. Catal., class I.)

*Obv.* Horse, standing to l. unattended, occupying most of field. In front of horse an altar, from top of which springs a bent pole,

carrying three long streamers (described as 'waving flame' by Wilson), which occupy top of field. Between horse's legs is 'Se,' of which meaning is not known, but the same character is found on the footstool on *obv.* of Samudra's Lyrist coins. Marginal legend imperfect; as restored by Thomas it reads नवजसप्तः राजधिराज इयिवी जियत्य, 'King of kings, having conquered the earth ...'; the first word appears corrupt.

*Rev.* Female, standing to l. holding in r. hand handle of yak's tail fly-whisk (*chauri*), which rests on her r. shoulder. In front of her a spear or standard, adorned with pennons; her l. hand hangs empty by her side. Legend in r. field अश्वमेध पराक्रमः, 'the hero of the Aśwamedha.'

No monogram.

*References and Remarks.* P. E. XXIII, 31; in B. M. and labelled as from Kanauj, collected by Conolly, but Prinsep says it was given to him by Miss Watson. No *obv.* legend, except the character से under the horse.

Wt. 117.7; condition fair. Seems to be the coin described and figured in Records of Gupta Dynasty p. 22, Autotype Pl. fig. 4.

P. E. XXIII, 32; from Stacy collection; "more perfect" than preceding; traces of *obv.* marginal legend.

Wt. not stated.

B. M. Eden coll. Wt. 117; condition good: part of marginal legend. (*Pl. II, fig. 9.*)

B. M. Payne Knight coll.; condition poor; wt. 113.2.

„ Thomas coll.; worn, but part of *obv.* legend remains; wt. 117. This seems to be the coin from Sahāranpur figured in A. A. XVIII, 2.

Freeling coll.; mentioned in *J. A. S. B.* XXIV, 498; wt. 115.

B.; three specimens; wt. not stated.


E. C. B., in good condition; *obv.* marginal legend seems to read वि or वी, one letter, जयत्य the h at the end appears to me distinct; wt. 117.2.

A. C.; 1 specimen, no details stated.

Bush coll.; coin referred to in *J. A. S. B.* XXIV, 499, as appearing "to vary the *obv.* legend, but too much worn to be satisfactorily deciphered." Wt. not stated.

C.; obtained at Lucknow; *obv.* legend very imperfect; wt. 117.

Thomas describes the horse as 'richly bedecked,' or 'decked for the Aśwamedha sacrifice,' but in reality the animal wears nothing but a collar, and in the poorer specimens that has disappeared. The coins of this type are referred with confidence to the reign of Samudra, because (1) the obverse legend 'prithivī[m] jiyatya' recalls the phrase 'sarva prithivī'

*vijayanitodaya* ' of Samudra's Allahabad Pillar inscription, (2) the  under the horse is found on the footstool on the obverse of the same prince's Lyrist coins, (3) the epithet '*parákrama*' on the reverse is found on his Javelin and Archer coins and not on those of any other Gupta king, and (4) Samudra is known to have enjoyed power sufficient to warrant him in celebrating an Aśwamedha sacrifice.



*Quære*, is the standard in front of the horse the standard of Indra ?

### SAMUDRA GUPTA.

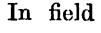
#### TIGER TYPE.

(*Class H. of Revised Catalogue.*)

*Obv.* King standing to r. wearing tight Indian waistcloth, turban, necklace, armlets, and large earrings, trampling on body of tiger, which is falling backwards, while he shoots it in the mouth. Bow in king's r. hand, his l. is raised above shoulder. Between king's feet a letter (?)

Legend on r. margin  ... 'the tiger' ... Thomas completes it with the word  'hero,' but the letters are really very imperfect and dubious.

*Rev.* Goddess to l. standing on a dragon or marine monster which faces l. grasping in her r. hand a crescent-tipped standard adorned with pennons, resembling that on *obv.* of Boy and Battle-axe coins of Samudra, and in l. hand an expanded lotus-flower.

In field to r. , 'Rájá Samudra Gupta.' No monogram. Wt. of one coin 116.6.

*References and Remarks.* B. M. unique; described in Rev. Catal.; described and figured in Records, p. 21, and Autotype Plate, fig. 2. (*Plate II, fig. 10.*) In Hindu mythology the dragon (*makara*) is the vehicle both of Varuṇa, the god of the waters, and of Káma Deva, the Indian Cupid. Perhaps the goddess on this coin represents Rati, the wife of Káma Deva, or, more probably she may be intended as the consort of Varuṇa, with reference to the name of the king, Samudra, which means 'the ocean.\*' Thomas notes that a similar monster is to be seen under the feet of a statue found at Nongarh, and made of Ma-thurá sandstone.

### SAMUDRA GUPTA.

#### BOY AND BATTLE-AXE TYPE.

(*J. A. S. B. XXIV, pp. 496-7, class C 2: Rev. Catal. classes F and 2 F.*)

*Obv.* King standing, usually to l., with r. hand on hip, and l. resting on battle-axe. In l. field a boy holds in front of king a

\* Cf. the introduction of Demeter in the coins of Demetrius of Syria. The form of the creature on which the reverse goddess stands is not very distinct, and Prof. Gardner thinks it more like the head of an elephant than anything else.

standard bearing device of crescent moon. Under king's l.

स

arm न, Samudra. In var.  $\gamma$ , king is to r., and boy in r. field

Marginal legend in vars.  $\alpha$  and  $\gamma$ , as "obtained from several specimens, and determined by Major Bush's coin," is **हताक्ष परम राजधिराज**, "King of kings, whose battle-axe is like that of Yama"; but in var.  $\beta$  legend is different.

*Rev.* Throned goddess, facing front, with feet on lotus flower as footstool; fillet in r. hand, cornucopia in l. arm. Legend **हताक्ष परम**, 'the battle-axe of Yama.' Mon.

*References* Var.  $\alpha$ ; usual type, as described above.

*and* P. E. XXIII, 23; B. M., Prinsep; obtained by Conolly at Kanauj; above crescent standard a star; on *rev.* an axe-head attached to back of throne; mon. 6a; wt. 116·7.

*Remarks.* P. E. XXIX, 11; one of two specimens obtained by Cunningham at Benares, Prinsep had 'a third similar; mon. 6a. nearly; wt. not stated.

B. M., Thomas; no *rev.* battle-axe, throne indistinct; mon. as in P. E. XXIX, 11; wt. 117·0.

B. M., Bush; *rev.* as in B. M. Thomas, but legend distinct; mon. 6a; wt. 123·4. (*Plate II, fig. 11.*)

A. S. B.; no details stated, and the coin may belong to another variety.

A. C.; 1 specimen, seemingly of this var., but no details stated.

Var.  $\beta$ , class 2 F of *Rev. Catal.*; unique.

B. M., Eden; *obv.* legend on l. margin **जजतज**, and on r. margin **हताक्षप**; under arm छ 'Kṛi'; mon. 3a; wt. 117·7. (*Plate II, fig. 12.*)

Var.  $\gamma$ ; unique; King to r.

A. A. XVIII 10; from Swiney coll.; king to r., boy in r. field; no *rev.* battle-axe; mon. 3a; wt. not stated.

Thomas suggests that the miniature figure, which for convenience I call a boy, may be intended for the son of Samudra Gupta, alluded to in the Allahabad Pillar inscription, but the figure is probably only that of an attendant designed on a small scale in contrast with that of the divinized king. The *obv.* crescent moon standard is found on *rev.* of Samudra's Tiger type. In v. 13 of the Allahabad Pillar inscription the king is declared to be comparable with Dhanada (Kuvera), Varuṇa, Indra, and Antaka (Yama). These Boy and Battle-axe coins seem to express the comparison with Yama, as the Tiger coin perhaps expresses the comparison with Varuṇa. In the northern Bilsar inscription (*Cunningham Arch. Rep. XI, 20*), Kumāra Gupta is compared with the same four

gods to whom Samudra Gupta is likened in the Allahabad inscription, and he is given the title of "wielder of the battle-axe of death." The use of this epithet convinces me that in the Boy and Battle-axe coins Samudra Gupta is presented as the incarnation or representative on earth of Yama or Kṛitānta, the god of Death, who was also regarded as the 'king of justice, (*dharmmarāja*). In order of time this type should, perhaps, be placed before the Aśwamedha and Tiger types, which are more distinctively Hindu.

## CHANDRA GUPTA II.

## COUCH TYPE.

(Rev. Catal., class E a.)

*Obv.* King seated on couch, with r. leg tucked up; attitude nearly the same as in Lyrist type of Samudra, but there is no lyre; king's l. hand rests on couch, r. hand upraised, empty; marginal legend (a few letters being indistinct), देव श्री महाराजाधिराज श्री चन्द्र गुप्तस्य, '[coin of the divine king of kings, Chandra Gupta.]' Cf. legend of Archer type.

*Rev.* Goddess seated on throne, holding fillet in r. and flower in l. hand. Monogram. Legend श्रीविक्रमः 'Sri Vikrama.'

*References and* B. M.; coin unique, so far as is known; worn, wt. 114·7; mon. (3a) (Pl. II, fig. 13).

*Remarks.* Assigned to Chandra Gupta II on account of rev. legend, and the title of 'Deva'; probably belongs to an early period of his reign. The Sānchi inscription (*P. E. I*, 246; etc.) states that Chandra Gupta II was 'known among his subjects' as Deva Rāja; his son Kumāra in a Horseman to Right coin (*A. A. XVIII*, 16) describes himself as 'Devajanita,' the son of Deva, or 'the divine,' and himself assumes the title of 'Deva' in an unpublished gold Archer coin (*Rev. Catal.*, class 6 E b), and in some of his silver 'peacock' coins.

Genl. Cunningham informs me that this coin, or one like it, is figured in a book entitled *Oriental Collections* (4to.), Vol. 2, p. 425, Pl. A. fig. 2.) but I have not seen the book referred to.

## CHANDRA GUPTA II.

## ARCHER TYPE.

(J. A. S. B. XXIV, p. 499, class C 1; Rev. Catal., class E and 2 E.)

*Obv.* King standing, wearing tailed coat, ordinarily turned to l., his l. hand grasps and rests on bow, of which the string is ordinarily turned inwards; arrow in r. hand, and bird-stand-

ard behind r. arm. Under l. arm च 'Chandra.'

In var.  $\delta$  of Class II, king faces r., with bow in r. hand, and name under r. arm; in var.  $\epsilon$ , he faces r., with bow in l. hand.

In var.  $\beta$  either a wheel or uncertain object over king's r. shoulder. Marginal legend, restored, देव श्री महाराजाधिराज श्री चन्द्र गुप्तः 'the divine king of kings, Chandra Gupta.' *Of* legend of Couch type.

*Rev.* Goddess, facing front, and seated either on throne (*Class I*), or cross-legged on lotus-flower (*Class II*), holding in r. hand a fillet, and in l. either a cornucopia or lotus-flower. Legend श्री विद्मसः, 'the hero'; the क is sometimes doubled. Mon.

#### CLASS I.—THRONE REV.

##### References and Remarks.

- Var.  $\alpha$  ; bow-string inwards.*  
P. E. XXIII, 18; dug up at Jaichandra's Mahal, Jaunpur, by Tregear, along with Samudra's Archer coin. (P. E. XXIII, 19); cornucopia in l. hand of *rev.* goddess; mon. 21; wt. not stated.  
A. G.; mon. 16; wt. 113.2; from Oudh.  
A. C.; 1 specimen, seemingly of this var., no details stated.  
P. E. XXIX, 13; "a very perfect example from Cunningham's cabinet, procured at Mirzāpur;" flower in l. hand of *rev.* goddess; mon. 3a; wt. not stated.  
The B. M. Prinsep coin belongs to Class II.  
C.; from Cawnpore (?); wt. 118.90.  
*Var.  $\beta$  ; bow-string outwards. (Class 2 E of Rev. Catal.)*  
Marsden, MLVII; *rev.* goddess holds cornucopia; mon. 23; wt. 118.  
I. O., No. 8; corresponds closely with Marsden's coin, but mon. 4c; *obv.* legend देव श्री महाराजाधिराज; wt. 120.9. This is probably the coin from Barhal in Gorakhpur, with same *obv.* legend. (See J. A. S. B. XXIV, 499.) Plate II, fig. 14.

#### CLASS II.—LOTUS-FLOWER SEAT REV.

- Var.  $\alpha$  ; usual type, as described above ; king to l.*  
P. E. XXX, 9; from Tregear coll.; flower in l. hand of *rev.* goddess; mon. 22; wt. not stated.  
No. 2 of Tod's 4th series; as above; mon. 8b; wt. not stated. (Tr. R. A. S. I. Pl. XII.)  
Bharsar hoard, No. I of of Chandra Gupta; as above; mon. 8a; wt. 124; a duplicate weighed 126. (J. A. S. B. XXI, 394-5, 400.)  
ditto, No. 5 ditto; mon. 8a; wt. 112.  
As. Res. XVII, Pl. I, 13; from drawing of a coin belonging to Col. Willoughby of Patna; mon. 8b; wt. not stated.  
Marsden, ML; mon. 20a; wt. 124.5; two ks in *rev.* legend.  
B. M., Brind; mon. 10a; wt. 117.8.

- B. M., Prinsep ; mon. 8b ; wt. 121·7.  
 „ T. ; mon. 8b ; wt. 126·3.  
 B. M., Yeames 4 ; mon. 8b ; wt. 124·7.  
 „ „ 5 ; mon. 1b ; wt. 119·2.  
 „ „ 6 ; mon. 10a ; wt. 121·8.  
 „ Eden ; mon. 7a ; wt. 124·3 ; two *ks* in *rev.* legend ; a fine specimen. (*Pl. III, fig. 1.*)  
 „ Swiney ; mon. 10b ; wt. 124·6 ; two *ks* ; fine condition.  
 I. O. No. 3 ; mon. 24 ; wt. 125·5.  
 „ „ 4 ; mon. 3b ; wt. 123 ; two *ks* ; fine condition ; is probably the coin figured in A. A. XVIII, 4.  
 „ „ 5 ; mon. 24 ; wt. 127·6 ; two *ks*.  
 „ „ 6 ; mon. 8a ; wt. 119·7 ; ditto.  
 „ „ 7 ; mon. 17a ; wt. 126·5 ; ditto.  
 W. T. ; mon. imperfect ; wt. 120.  
 A. S. B. ; 8 specimens ; mon. of all *seems* to be 8b ; wts. not stated.  
 In 3 coins the l. hand of *rev.* goddess is described as being upraised, and in 5 coins as resting on her hip ; probably the lotus-flower is obliterated. A ninth specimen is said to be of base metal, and is probably one of the barbarous coins.  
 A. C. ; 5 specimens, seemingly of this var., no details stated.  
 Húglí hoard ; 4 coins seem to belong to this variety ; of three the mon. is 19b, and of one, 19a ; wts. not stated.  
 Coin from Rewa treasury ; apparently of this variety, with two *ks*. (*Proc. A. S. B. Aug. 1880.*)  
 H. ; 1 specimen, from ancient mound in Barabanki district.  
 C. ; from Gházipur ; wt. 118·60.

This variety of Chandra Gupta's coinage is the commonest of all the Gupta gold coins, and was the model followed by the princes who imitated the Gupta style after the fall of the imperial dynasty. The abundance and variety of the coins of Chandra Gupta II prove that his reign was a long one.

*Var. β ; as var. α, but with wheel (or sometimes another object) over king's r. shoulder ; weight heavier.*

- Bharsar hoard, No. 2 of Chandra Gupta ; mon. 15 ; wt. 130 ; a duplicate weighed same. (*J. A. S. B. XXI, p. 394, Pl. XII. 1.*)  
 I. O., No. 9 ; mon. 18 ; wt. 132·5 ; (*Plate III, fig. 2.*)  
 „ „ 10 ; mon. 17b ; wt. 132·5.  
 „ „ 11 ; mon. 8a ; 126·6 ; worn.  
 „ „ 12 ; mon. 8b ; wt. 126·7 ; ditto.  
 „ „ 13 ; mon. 8a ; wt. 129·5 ; ditto.  
 A. G. ; uncertain object instead of wheel ; mon. cut away ; wt. 130·4 ; *k* in *rev.* legend seems double ; oval and rather rude coin ; from Oudh.



Perhaps A. A. XVIII, 21, from Kálighát hoard should be placed here, but the wt. is not stated. A coin from the Húglí hoard with uncertain object on *obv.*, and a peculiar mon. on *rev.* may also belong to this var., but without knowledge of the wt., it is impossible to decide. Kittoe interprets the wheel on the Bharsar coin as the "wheel or discus emblem of universal sovereignty," but I prefer to regard it as a solar emblem; it much resembles the head of Ghaṭot Kacha's solar standard. I should think that this variety belongs to a late period of Chandra Gupta's long reign, and it may possibly be posthumous. The weight separates it sharply from all his other issues, except the next following variety.

*Var. γ; as var. β, but wheel is replaced by crescent.*

Bharsar hoard; No. 3 of Chandra Gupta; mon. 8a; wt. 126; a duplicate weighed the same; coin small; gold pale and alloyed; (*J. A. S. B. XXI, Pl. XII, 2.*)

*Var. δ; king to r., bow in r. hand, name under r. arm.*

Bharsar hoard; No. 4 of Chandra Gupta; mon. 8a; wt. 112; small coin, gold pale. (*J. A. S. B. XXI, Pl. XII, 3.*)

I. O., No. 1; mon. 8a; wt. 118·4; worn. (*Plate III, fig. 3.*)

*Var. ε; king to r., bow in l. hand, name under l. arm.*

I. O., No. 2; mon 4c; wt. 122·3.

Coin from Bulandshahr; mon. and wt. not stated (*Proc. A. S. B. April, 1879*). A coin in the A. S. B. cabinet seems to belong to this var., and may be the Bulandshahr specimen.

For the heavy 'barbarous' coins of Archer type, see Supplement.

## CHANDRA GUPTA II.

### LANCER TYPE.

(*J. A. S. B. XXIV, 499, class F; Rev. Catal., class J.*)

*Obv.* King on prancing horse, proceeding to r., with lance at charge, either helmeted, and without nimbus, or bareheaded with curly hair, and nimbus; sometimes a crescent behind his head.

Legend, as read by Thomas, परम भग जा श्री चन्द्र गुप्त: 'parama bhaga[vato rá]já Śrī Chandra Gupta;' but in the B. M. specimens the ग and जा are very doubtful.

*Rev.* Goddess, to l., seated upright on Indian wicker stool (*morhá*), with fillet in r. and either lotus-flower, or bird-headed sceptre in l. hand. Legend always अजित विज्जितः, 'the unconquered Vikrama,' or 'champion.'

No mon. except in one coin

- References and Remarks.* *Variety α*: Rev. goddess with fillet, and flower; no mon.  
P. E. XXX, 6; from Tregear coll.; king helmeted; no nimbus; crescent behind his head; wt. not stated.  
B. M. Prinsep, No. 1; obtained by Bacon at Kanauj; king seems to have no helmet, but has curly hair, with a sort of nimbus behind; crescent also behind his head; wt. 119.7. (*Plate III. fig. 4*)  
B. M. Prinsep, No. 2; resembles No. 1, but find-spot not stated; wt. 118.6.  
A. C.; 1 specimen, seemingly of this var., but no details stated; the coin may be a Horseman to Left piece.  
*Variety β*: Rev. goddess with fillet, and bird-headed sceptre; mon.  
A. A. XVIII, 17; Obv. king wears peculiar helmet ("rayed turban," Wilson); no nimbus, no crescent; legend परम ... चन्द्र गुप्त, 'parama [Cha]ndra Gupta.' Rev. as in P. E. XXX, 6, except that goddess holds bird-headed sceptre in l. hand; mon. 12, not No. 160 of Wilson = (4b) as stated in text; between mon. and goddess' hand is a crescent, ☾; wt. not stated. This coin is cited by Thomas (*Rev. Catal. and Records*, p. 23 note) as a variety of his class J a of Mahendra Gupta, but is plainly a Lancer coin of Chandra Gupta.  
B.; one fine specimen appears to belong to either variety of the type, but details not stated.

## CHANDRA GUPTA II.

### HORSEMAN TO LEFT TYPE.

(Not included in J. A. S. B. XXIV catal.; nor in Rev. Catal.)

*Obv.* Horseman proceeding to l. king's head apparently bare, with curly hair, no nimbus; distinct legend श्रीचन्द्र गुप्तः परमभट्टारक 'Śrī Chandra Gupta paramabhaṭṭāraka.'

*Rev.* Goddess to l. seated on Indian wicker stool (*morhā*), holding fillet in r., and lotus flower in l. hand; legend distinct, अजित विक्रम, 'ajita Vikrama'; no mon.

- References and Remarks.* No. 6 of Chandra Gupta from Bharsar hoard; "a very perfect specimen," legends complete; wt. 122 (J. A. S. B. XXI, 395; Pl. XII, 4.)  
No. 3 of Mahendra (?) ditto; obv. legend incomplete, and not deciphered; rev. legend अजित ... 'ajita'. This coin evidently should be assigned to Chandra Gupta; in the Horseman to Left coins of Kumāra Gupta Mahendra the rev. goddess is feeding a peacock. Wt. 124. (J. A. S. B. XXI, 399.)  
W. T.; obv. legend not read; rev. legend and device as in J. A. S. B. XXI, Pl. XII, 4; wt. 122.

## CHANDRA GUPTA II.

### LION-TRAMPLER TYPE.

(*J. A. S. B. XXIV, p. 501, class G 2; Rev. Catal., class K b.*)

**Obv.** King, wearing waistcloth, standing in energetic attitude, shooting in mouth a lion, which, in vars.  $\alpha$ ,  $\beta$ ,  $\delta$ , is falling backwards with the king's l. foot on its belly. In var.  $\gamma$ , the lion is standing with the king's l. foot on its back.

In vars.  $\alpha$ ,  $\beta$ ,  $\gamma$ , king is turned to r., with bow in l. hand, but in var.  $\delta$ , he faces l., with bow in r. hand.

Legend not deciphered, but, in var.  $\delta$ , it includes the words 'Vikrama ... Gupta.'

**Rev.** Goddess, seated cross-legged, facing front, on couchant lion, which faces l., holding fillet in r., and lotus-flower in l. hand; but, in var.  $\beta$ , she sits astride, holding lotus-flower in r., while l. hand is empty.

Legend in all var., सिंह विक्रमः, 'the lion-champion.' Mon. generally, except in var.  $\beta$ .

**References and** *Var.  $\alpha$ ; king to r., bow in l. hand, trampling on lion's belly; rev. goddess cross-legged, facing front.*

**Remarks.** P. E. XXX, 1; mon. 8a; wt. not stated; from Tregear coll. No. 3 of Tod's 4th series; mon. 8b; wt. not stated. (*Trans. R. A. S. I., Pl. XII*).

A. A. XVIII, 5 = B. M., Swiney 5; mon. 10c; wt. 115.4; erroneously described by Wilson. (*Plate III, fig. 5*)

W. T.; mon. 7b; wt. 122.

A. C.; 2 specimens, "king killing lion," but no details stated, and the coins may not belong to this var.

B.; one specimen, belonging either to this variety, or to  $\beta$ , or  $\gamma$ ; details not stated.

*Var.  $\beta$ ; obv. as in  $\alpha$ ; rev. goddess astride on lion, with lotus-flower in r. hand, l. hand empty.*

E. C. B; no mon.; wt. 118.2; worn.

*Var.  $\gamma$ ; king to r. with foot on back of lion, which stands with head turned round.*

P. E. XXX, 2; mon. 10b; wt. not stated; fillet on rev. not visible; design spirited, and well executed; from Tregear collection.

*Var.  $\delta$ ; king to l., with bow in r. hand, trampling with r. foot on lion's belly.*

P. E. XXIII, 27; mon. 4c; wt. not stated; obv. legend, as engraved, and as read by Prinsep, विक्रम नरान स मुक्तः 'Vikrama narāna ma Gupta,' but there must be some error. Erroneously described by Prinsep as a "sorry duplicate" of P. E. XXIII, 25 (Retreating Lion type), which is a very different coin. From Stacy collection.

B. ; two specimens.

No. 4 of Tod's 4th series ; mon. seems to be 20g ; wt. not stated ; obv. legend includes certainly विक्रम, 'Vikrama.'  
(*Trans. R. A. S. I. (1827). Pl. XII.*)

G. ; in obv. legend . . नारा . . 'narā' . . legible, so far confirming Prinsep's reading ; no mon. ; wt. 122.00 ; obtained at Benares. Perhaps the true reading is नरोत्तम, 'best of men' ; cf. Ghatot Kacha. Mr. Carnac also has a coin obtained at Benares with . . तवस . . 'tavasa' on obv., and rev. lion to right ; wt. 120.45. I omitted to note further particulars, and the coin is perhaps of the combatant Lion type.

Mr. Thomas (*J. A. S. B. XXIV p. 501, class G ; Rev. Catal., class K*) briefly describes as follows a coin in the Stacy collection, which he regards as being "a cast from a genuine original. Obv. king to r. armed with bow, shooting a lion ; legend सिंह विक्रम कुमार [गुप्तपति] सिंह महेंद्र, 'Kumāra Gupta, of might like a lion's, most prosperous.' Rev. Pārvatī seated on a lion, her r. hand extends the fillet, the l., which rests upon her knee, holds a flower ; legend सिंह महेंद्र, 'Sinha Mahendra ;' wt. 126 ; type P. E. XXX, 1." If this cast represents a genuine coin it is a most important document, as proving that both the titles 'Sinha Mahendra' and 'Sinha Vikrama' belong to Kumāra Gupta. But I think it probable that the cast is a forgery.\* The combination of titles has no parallel in any authentic coin, and the legend has the appearance of having been composed to solve the difficulty felt in assigning the 'Sinha Vikrama' coins. In the genuine Lion-Trampler coin of Kumāra's (*P. E. XXX, 8*) the rev. legend is 'Sri Mahendra Sinha ;' in the cast the word 'Sinha' is made to precede 'Mahendra.' Mr. Thomas, in his original catalogue (*J. A. S. B. XXIV, 501*) and in his Revised Catalogue assigns all the 'Sinha Vikrama' coins to Kumāra Gupta, being apparently led to this conclusion by the dubious Stacy cast. In his Records of the Gupta Dynasty (*p. 22*) he attributes the B. M. unique Retreating Lion coin with 'Sinha Vikrama' legend, (*P. E. XXIII, 25*) to Samudra Gupta. He does not state any reason for this attribution,

\* In a letter, written in May 1883, Mr. W. Theobald tells me ;—"There is a roaring trade just now doing in forgeries. Just before I left India, two years ago I saw upwards of 33 beautifully executed forgeries of gold coins with one man in Hazāra, and, what is more curious, I actually saw forged copper coins, but these only once in an out-of-the-way village, and the same man had a few forged silver Sophytes, one of which I bought ; but I have a genuine one also."

but it seems to be based on the similarity in design and execution between the coin in question, and Samudra's unique Tiger coin. But this similarity is not sufficient to outweigh all the other evidence. The Lion-Trampler coin (*P. E. XXX*, 8) with rev. legend 'Śrī Mahendra Sinha' is undoubtedly Kumāra's, for no one has ever supposed that the title Mahendra was shared by Samudra with Kumāra. The Combatant Lion coins (*P. E. XXIII*, 28 *etc.*), which bear on the reverse the name in full of Kumāra Gupta also resemble in obverse device the Tiger coin of Samudra, quite as much as the 'Sinha Vikrama' coins do. We know for certain that 'Vikrama' was a favourite title of Chandra Gupta II, and, after full consideration of the problem, I have no hesitation in concluding that General Cunningham (*Arch. Rep. X, III*), is right in assigning all the 'Sinha Vikrama' coins to Chandra Gupta II.\* The result is that both Chandra Gupta II and Kumāra Gupta must be credited with having issued coins both of the Lion-Trampler and Combatant Lion types, while the unique Retreating Lion coin must be assigned to Chandra Gupta II. Prinsep, with his usual acuteness, observed on the close similarity between the mintages of Kumāra Gupta and his father Chandra Gupta II.

## CHANDRA GUPTA II.

### COMBATANT LION TYPE.

(Not included in either of Mr. Thomas's catalogues.)

*Obv.* King, standing to r., in attitude less energetic than that of Lion-Trampler type, bareheaded, with bow in l. hand, shooting lion in mouth, but not trampling on its body. Sometimes, above king's l. arm, and in front of his face, a character 'h' ? Legend of about 20 characters, including perhaps, ... रत चन्द्र, '... rata Chandra' ?

*Rev.* Goddess, holding fillet in r., and lotus-flower in l. hand, seated, facing front, cross-legged on back of lion couchant to l. Legend श्री विक्रमः, 'Śrī Vikrama' ; the k is sometimes doubled. Coins poorly designed and executed. Mon.

|                   |                  |                                                                                       |
|-------------------|------------------|---------------------------------------------------------------------------------------|
| <i>References</i> | E. C. B. ;       | on left <i>obv.</i> margin 6 or 7 character, not read,                                |
| <i>and</i>        |                  | on r. रत चन्द्र, 'rata Chandra' ? ; character before                                  |
| <i>Remarks.</i>   |                  | king's face ; mon. 8b ; wt. 120·9.                                                    |
|                   | B. M. Swiney 4 ; | no character before king's face ; mon. 10c ; wt. 111·4. ( <i>Plate III, fig. 6.</i> ) |
|                   | A. G. ;          | <i>obv.</i> legend of about 20 characters ; mon. 10c ; wt. 117·4 ; from Oudh.         |

\* In his latest publication on the subject (*Epoch of the Guptas*, p. 24, from *J. R. A. S. for 1880*) Mr. Thomas refers to the reign of Chandra Gupta II both the Sinha Vikrama and the Vikramāditya coins. The late Sir E. C. Bayley concurred in this assignment.

The same character, in the same position before the king's face, is found in Kumára Gupta's Archer type, class I, var.  $\beta$ ; its meaning is not known.

## CHANDRA GUPTA II.

## RETREATING LION TYPE.

(J. A. S. B. XXIV, 501, class H, 1; Rev. Catal., class L.)

*Obv.* King standing to front, head turned to l. wearing tight waistcloth, armlets, large earrings, and necklace; hair braided or curled, perhaps covered by a close cap. He holds in r. hand bow, and in l. an arrow pointed downwards, having just discharged arrow at retreating lion, which occupies l. margin, and in whose snout the arrow-head is sticking. Legend on r. margin महाराजधिराज श्री, 'Maharājādhirāja Śrī.'

*Rev.* Goddess (Durgā?) seated on couchant lion, which faces l.; in her r. hand fillet, and in l. which rests on her hip, a lotus-flower. Her r. leg is tucked up under her, the l. hangs down behind the lion's rump. Legend श्री सिंह विक्रमः, 'the lion champion'; vertical line between device and legend. Mon.

*References and Remarks.* Unique coin; P. E. XXII, 25, and Vol. I. pp. 27 and 280; Records. p. 22 and Autotype Pl. fig. 8; in B. M.; obtained at Kanauj by Lieut. Conolly; mon. 4c; wt. 123. A broad coin of artistic design, and spirited execution. (Plate III, fig. 7.) For discussion of question of attribution see remarks under Lion-Trampler type of Chandra Gupta II.

## CHANDRA GUPTA II.

## SWORDSMAN AND UMBRELLA TYPE.

(J. A. S. B. XXIV, 492, class A 1; Rev. Catal., classes B and 2 B.)

*Obv.* King standing, facing l., barcheaded, with long curly hair, with l. hand resting on short sword (*khandā*), and with r. hand casting incense on small altar, which is, however, sometimes wanting. Beside king's l. arm a miniature figure holding handle of state-umbrella, which shades the king. Marginal legend, restored from comparison of specimens, विक्रमादित्य विजितवज्रित्य सुचरति, 'Vikramāditya, having conquered the earth, prospers.'

*Rev.* Standing female figure (? Victory, *Wilson*), either full front, or facing l. with fillet in r. hand, and sometimes a flower in l.: her dress slightly varies in different coins.

Legend विक्रमादित्य 'Vikramāditya,' sometimes spelled with two *ks*. Monogram sometimes wanting.

- References and Remarks.*
- P. E. Vol. I, 372, Pl. XXX, 7; from Tregear coll., and at that time unique; no altar on *obv.*; one *k* in *rev.* legend; no mon.; wt. not stated.
- A. A. XVIII, 1; from E. I. O. coll. but not now in I. O.; no *obv.* altar; no flower in l. hand of *rev.* goddess, but a knobbed staff behind her; double *k* in *rev.* legend; no mon.; wt. not stated; more Indian in style than Prinsep's coin.
- B. M., Eden No. 1; *obv.* altar partly visible, with incense falling on it; *rev.* in fine condition; open lotus-flower in goddess' left hand; no staff between her and legend, which has only one *k*; mon. apparently 8*b*; wt. 119.3. (*Plate III, fig. 8.*)
- ditto, ditto, No. 2; poorer specimen; umbrella cut away; mon. imperfect; wt. 117.5.
- B.; three specimens.
- Freeling No. 1; *obv.* altar; *rev.* goddess holds flower in left hand; mon. No. 159 A. A.; viz. 3*a*; two *ks* in *rev.* legend; wt. 121. (*J. A. S. B. XXIV, 492.*)
- ibid.*, No. 2; *rev.* goddess full front, with transparent drapery; mon. resembling that of Ghaṭot Kacha's coin, P. E. XXIX, 12, but with double crossbar; one *k* in *rev.* legend; wt. 121. (*ibid.*, class 2 B.)

These coins are ascribed by Thomas to Chandra Gupta I, and are so classed in B. M., but are ascribed by Cunningham to Chandra Gupta II, and in this attribution the late Sir E. C. Bayley concurred. The design of the *rev.* rather favours the former supposition, but the king's curly hair, and the *obv.* legend, which is nearly identical with that on Kumāra's unique Swordsman coin, are in favour of the latter. The reduplication of the *k* in the *rev.* legend of some of the coins in question is also found in Chandra Gupta II's Archer coins. The average weight is consistent with the attribution of these coins to either prince. Considering the fact that Chandra Gupta II in his silver coins used the titles विक्रमादित्य and विक्रमार्का as well as विक्रमादित्य, I have no doubt that these gold coins with the title of विक्रमादित्य should be referred to him. This title is also found on one of the heavy coins of barbarous execution, bearing the name of Chandra, which is described in the Supplement. Mr. Theobald has a large copper coin (a duplicate of P. E. XXX, 11) with legend 'Mahārāja Śrī Chandra Gupta,' the obverse of which seems to be a rude imitation of these gold coins; wt. 71. Gen. Cunningham compares the *obv.* device with a sculpture, apparently of Gupta age, at Bhitari in the Ghāzipur district. (*Arch. Rep. p. 99.*)

## KUMĀRA GUPTA (MAHENDRA).

## SWORDSMAN TYPE.

(Rev. Catal., class D a.)

*Obv.* King, facing front, with long curly hair, wearing a cap or turban, short drawers, necklace, and armlets; with r. hand casting incense on small altar, which is partly visible; a short sword hangs from his waist, and his l. hand rests on his hip. Behind r. arm. bird-standard, adorned with pennons. Beside left elbow कु 'Ku,' with a crescent over the syllable. Legend on margin [क्षि]तिमवजित्य क्षुचरति कुमार, 'Kumāra, having conquered the earth, prospers.'

*Rev.* Goddess, seated cross-legged on lotus-flower seat with fillet in r., and open lotus-flower in l. hand. Legend श्री कुमार गुप्त 'Śrī Kumāra Gupta.' Monogram.

*References and Remarks.* Unique coin in B. M. Prinsep coll.; described and figured in Records, p. 23 and Autotype Pl. fig. 5. The first two words are read गमव जित्य by Thomas, which is unintelligible: I read his ग as a न, with one limb a little prolonged—the remains of the क्षि are on the left margin; a crack crosses the क्ष, but the letter is quite distinct the legend thus agrees with that on the Swordsman and Umbrella coins of Chandra Gupta II, father of Kumāra. The crescent over the obverse कु is remarkable, because it is generally found only in the heavy debased coins of the type of Nāra Gupta's coinage. The wt. 124.2 of the present coin indicates that it belongs to the genuine mintage of the imperial Kumāra Gupta. The execution of the coin is clumsy, but not very barbarous. Mon. 8b (Plate III, fig. 9.)

## KUMĀRA GUPTA (MAHENDRA.)

## ARCHER TYPE.

(J. A. S. B. XXIV, 500, class O 1, and varieties; Rev. Catal. classes 5 E b, 6 E b, 7 E b, and E c.)

*Obv.* King, standing to l., head bare, hair curly, r. hand extended across bird-standard, holding arrow; l. hand either resting on tip of bow with string turned inwards, or grasping middle of bow with string outwards.

Sometimes, but not always, कु 'Ku,' under l. arm.

Legend on margin, or in field, various, as detailed below.

*Rev.* In all vars.; goddess seated cross-legged on lotus-flower seat; and holding fillet in r., and lotus-flower in l., except in class II, where her hands are empty.

Legend श्री महेंद्र, 'Śrī Mahendra.' Mon.

Class I. String of bow turned inwards.



- References and Remarks.* *Var. α* ; *obv. legend* **अयति महेंद्र**, 'Mahendra conquers.'
- P. E. XXIX, 20 ; from Cunningham's coll. ; obtained at Gayā ; under king's arm **कु**, 'Ku,' apparently with crescent over it ; remains of a letter before his face ; mon. 25, slightly modified ; wt. not stated.
- A. A. XVIII, 12 ; duplicate of above ; wt. not stated.
- Bharsar hoard, No. 2 of Kumāra Gupta ; as above ; mon. 25 ; wt. 123.
- ditto, No. 4 of Kumāra Gupta ; as No. 2, but no *obv. legend* except 'Ku' ; mon. 25 ; wt. 124.5. (*J. A. S. B. XXI, 397.*)
- No. 1 of Tod's 4th Series ; as P. E. XXIX, 20, but legends on *obv.* indistinct ; mon. 20 a ; wt. not stated. (*Trans. R. A. S. I, Pl. XII.*)
- B. M., Eden ; *obv. legend* not read ; mon. 8b ; wt. 124.7. (*Plate III, fig. 10.*)
- „ Prinsep ; ditto ; worn ; wt. 106.7.
- Communicated by E. C. B. ; two specimens found at Jhūsi near Allahabad along with eight of Peacock type of Kumāra Gupta.
- C. ; one specimen dug up near Allahabad along with a Peacock coin ; probably part of the Jhūsi find.
- A. S. B. ; 3 specimens perhaps belong to this variety, but details are wanting ; one seems to have no. *obv. legend*, two have **कु** 'Ku' under arm.
- Var. β* ; *obv. legend* as stated below ; a character, seemingly, 'h,' before king's face.
- A. S. B. ; figured in P. E. XXXIX, 19, and As. Res. XVII Pl. I, 14 ; a character before king's feet ; *obv. legend*, as read by Dr. Hoernle, 'Parama rājādhirāja Śrī [Kumāra Gupta Mahen]dra,' but of the words in brackets only the lower portion is legible, and the restoration is conjectural ; wt. not stated.

For the character before the king's face, *cf.* the Combatant Lion type of Chandra Gupta II, this character seems to me to be 'h,' and not 'Gu.' The word 'parama' in the legend also recalls Chandra Gupta's Lancer and Horseman to Left types, but the 'Mahendra' of the *rev.* legend proves this coin to belong to Kumāra Gupta.

*Var. γ* ; under king's arm **कु**, 'Ku' ? *obv. legend*, as stated below.

A. G. ; mon. 8b ; wt. 125 ; from Oudh. The *obv. legend* includes the letters ... **जतर** ... 'jatara.'

*Var. δ* ; class 6 E b of *Rev. Catal.* ; *obv. legend* as below.

Freeling coll. ; unpublished, briefly referred to by Thomas in his catalogues and in Records, p. 50 ; wt. 125. *Obv. legend* [दे]व विजितावमिरवमिपति कुमारो गुप्तो,

'the divine (or Deva) Kumára Gupta, lord of the earth, who has conquered the earth.' Some of the peacock type of the silver coins have the same legend, with the word **अवति**, 'conquers,' inserted after 'Deva.'

*Var. e*; *obv. legends as stated below*; *class 7 E b of Rev. Catal.*

Stacy coll.; unpublished; briefly noticed by Thomas in his catalogues; wt. 126; no initial under king's arm; L marginal legend **कुमार गुप्त**, 'Kumára Gupta.'

*Var. f*; *obv. legends as stated below.*

Coin from Mahanada; **कु**, 'Ku' under king's arm; *obv. legend श्री महाराजधिराज श्री कुमार गुप्त*, 'Sri Mahárája-dhirája Śrī Kumára Gupta'; further details wanting. (*Proc. A. S. B. May, 1882, p. 91.*)

In J. A. S. B. XXIV, 500, Thomas refers to a cast coin in Freeling coll., which partially agrees with the Mahanada coin, but it is useless to discuss specimens of doubtful genuineness.

#### CLASS II.—STRING OF BOW TURNED OUTWARDS.

- P. E. XXIX, 16; Cunningham coll., from Gayá; no initial under king's arm; **कुमार**, 'Kumára' outside bow-string; marginal legend **म[हेन्द्र]**; *rev.* goddess with both hands turned up, and elbows resting on knees; mon. 8c; wt. not stated; rude coin of irregular outline.
- A. A. XVIII, 11; nearly identical with above; mon. 8b; wt. not stated; "a very rude coin."
- B. M.; mon. 19b; wt. 121.4.  
ditto; mon. 10c; wt. 119.5.  
I. O.; mon. 10c; wt. 123.5. (*Plate III, fig. 11.*)  
A. S. B.; one coin seems to belong to this variety.

Three coins from the Húglí hoard, with the several mons. 8b, 17c, and 17d, belong to the Archer type of Kumára Gupta, but, in the absence of details, I cannot classify them more exactly. A. O. has one specimen, which, for the same reason, cannot be placed. The variety in the imperfectly deciphered obverse legends of this type is remarkable; the Horseman coins of the same king exhibit a similar variety.

For heavy barbarous coins of Archer type see Supplement.

#### KUMÁRA GUPTA MAHENDRA.

##### HORSEMAN TO RIGHT TYPE.

(*J. A. S. B. XXIV, 502, class F 2*; *Rev. Catal., class J a.*)

*Obv.* Horseman proceeding to r., bare-headed, with curly hair;  
\* no lance; in some cases an obscure character over horse's

head; sometimes a character, apparently वि 'vi,' between horse's legs; marginal legend, various, as detailed below, and generally imperfect.

*Rev.* Female seated to l., on Indian wicker stool (*morhá*) and (α) holding fillet in r. hand, and lotus-flower in l., behind her back; (β) holding in r. hand, a lotus-flower, springing from a curious undefined object, her left hand resting empty on hip; (γ) offering fruit to a peacock with r. hand, and holding lotus-flower in l.

Legend always अजित महेन्द्र 'the unconquered Mahendra.' Monogram generally wanting.

- References and Remarks.* *Var. α; Reverse goddess sitting upright, holding fillet and flower.*  
P. E. XXIII, 29; from Lt. Burt's coll.; obscure character, perhaps meaning 'Śrī' over horse's head; traces of letter between horse's legs; *obv.* legend illegible; *wt.* not stated.
- P. E. XXX, 4; as above coin; on r. *obv.* margin ... त वि ... 'ta vi,' legible; *wt.* not stated.
- A. A. XVIII, 16; closely resembles P. E. XXIII, 26, but, as Thomas points out (*Records*, p. 23 note) the *obv.* marginal legend ends with ... गुप्त देवजनत, 'Gupta of divine origin,' or 'the son of Deva'; a character over horse's head; *wt.* not stated, 'Deva' was a title of Chandra Gupta II. A. A. XVIII, 17 cited by Thomas (*ut supra*) as a variant, is really a Lancer coin of Chandra Gupta II, q. v.
- No. 5 of Kumāra from Bharsar hoard; fillet not visible, coin being "much worn"; a character over horse's head; *wt.* 124.5; a duplicate weighed 125. (*J. A. S. B.* XXI, pp. 398, 400; *Plate XII*, 8.)
- Húglí hoard; one specimen; *obv.* legend, as 'read by Dr. Hoernle, 'Parama bhagavata ... dhi rájá Guptaḥ'; *rev.* 'Ajita Mahendra'; *mon.* 8b. Cf. *var. γ*.
- Variety β; Reverse goddess, stooping, holding in r. hand an open flower, stalk of which springs from an unknown object; her l. hand rests on hip.*  
P. E. XXX, 3; *obv.* legend अजित पु [or प्र] ... त विक्र; 'ajita pu [or pra] ... ta vikra[ma]'; from Tregear coll.; *wt.* not stated.
- E. C. B.; *obv.* legend illegible; horseman seems to wear armour; *wt.* 126.5.
- Variety γ; Reverse goddess feeding peacock with right hand, holding lotus-flower with left.*  
P. E. XXIII, 30; B. M.; *obv.* legend ... त महेन्द्र गुप्त and 8 or 9 letters, '[aji]ta Mahendra Gupta .....'; between horse's legs वि 'vi'; given to Prinsep by Miss Watson; *wt.* 124.5; worn. \*

- Marsden, MLIX ; B. M. ; closely resembles above coin ; *obv.* legend ममन्त्र [P] गुप्त, 'Mahendra Gupta' ; traces of letter between horse's legs ; king has not "long-flowing" curls as stated in Records, p. 23 ; wt. 125.5.
- P. E. XXX, 5 ; resembles last, but Prinsep read two letters of *obv.* legend as हय 'haya' ; wt. not stated.
- A. G. ; from Oudh ; worn ; over horse's head a character, 'Śrī' ? ; between horse's legs वि 'vi' ? ; legend on right margin of ten characters, viz., प ति रज णि विज ङ्ग ; being part of the legend on the 'Midnapur Horseman to Left coin ; wt. 124.
- B. M., Eden ; character 'Śrī' ? over horse ; *obv.* legend विजय 'vijaya' on l. margin, and ... तब [ or प ] तर 'ta ba [or pa] ta ra' on r. margin, seemingly a part of the Midnapur Horseman to Left coin legend ; wt. 124.8.
- B. M., Bush ; character over horse's head ; in *obv.* legend देव, 'Deva' legible ; cf. A. A. XVIII, 16 ; condition fine ; wt. 127.2. (*Plate III. fig. 12.*)
- B. M., Yeames ; character over horse's head ; wt. 126.7.
- B. M., ——— ; do. do. ; wt. 125.9.
- B. M., E. T. ; worn, in poor condition ; no character over horse ; wt. 117.3.
- B. M., Yeames ; character over horse's head ; wt. 124.7.
- I. O., No. 1 ; character over horse's head ; worn ; wt. 124.
- „ No. 2 ; character over horse's head ; under horse वि, 'vi' ? ; wt. 125.8.
- „ No. 3 ; character over horse's head ; no letter under horse ; wt. 125.3.

A coin in A. S. B. cabinet with *obv.* legend 'Śrī Maharājādhirāj' is said to belong to this type, but details are wanting.

Háglí hoard, one specimen ; *obv.* legend, as read by Dr. Hoernle, 'Paramā bhagavata ... Śrī Ma[hendra Gu]pta,' rev. 'Ajita Mahendra.' Cf. var. a.

H. ; 1 specimen from a place in pargana Nawabganj of Gonda district opposite Ayodhya ; *obv.* legend 'Ajita Mahendra Gupta.'

## KUMĀRA GUPTA MAHENDRA.

### HORSEMAN TO LEFT TYPE.

(J. A. S. B. XXIV, 502, class F, 3 ; Rev. Catal. class J b.)

*Obv.* Horseman, bareheaded, with curly hair, proceeding to l., no lance ; sometimes a character (कु 'Ku' ?) over horse's head, or between its legs ; marginal legend imperfect and various, see details below.

*Rev.* Goddess seated, facing l. on wicker stool (*morha*), with r. hand feeding peacock, and with l. hand holding flower behind, her back. Legend अजित महेन्द्र 'the unconquered Mahendra. No monogram.

*References and Remarks.* As. Res. Vol. XVII, Pl. I, 18. *Obv.*, legend illegible, between horse's legs कु 'Ku' ? ; *wt.* not stated ; engraved "from a drawing of a coin said to belong to Mrs. White of Fatehgarh."

Freeling coll. ; unpublished coin, briefly alluded to in *Rev. Catal.* ; *wt.* not stated.

No. 1 of Mahendra from Bharsar hoard ; *obv.* legend indistinct, but read by Kittoo as 'Mahendra Gupta' ; *wt.* 124.

No. 2, ditto, ditto ; nearly identical with No. 1 but 'Ku' ? over horse's head, and long *obv.* legend, illegible ; *wt.*, 124 (*J. A. S. B. XXI, 399.*)

B. M. No. 1 ; *wt.* 126 (*Plate III, fig. 13.*)

" " 2 ; *wt.* 123.8.

" " 3, Enniskillen ; *wt.* 123.2. These B. M. coins read on *obv.*, .. वज्र जयति कु. Cf. Húglí coin below.

A. S. B. No. 1 ; from Shaurpur in Midnapur District, Bengal ; *obv.* legend भूपति राजति विजय कुमार गुप्त, according to Cunningham, who compared with three specimens in his own possession, the न्न being written त्य. Dr. Hoernle reads धि राज क्षितिपति राजति विजय कुमार [गुप्त ?] Either reading means 'the victorious lord Kumára Gupta rules.' The words विजय कुमार are between the horse's legs, and the word read भूपति, or क्षितिपति, or क्षचपति is round the horse's head and preceded by three letters, the last of which is distinctly क्ष. (*Proc. A. S. B. August 1882, pp. 111-114.*) Dr. Hoernle informs me that he now reads .. धि राज instead of श्री राज as printed, and that the coin belongs to Horseman to Left type.\*

A. S. B. ; No. 2 ; apparently similar, but no details stated.

Húglí hoard ; one specimen ; *obv.* legend as read by Dr. Hoernle ; 'Gupta Kshapra mahá ... ma ... vijita jayati' ; *rev.* 'Ajita Mahendra.'

A. C. ; 3 specimens, details not stated ; see above.

## KUMÁRA GUPTA MAHENDRA.

### PEACOCK TYPE.

(Omitted both in *J. A. S. B. XXIV*, and in *Rev. Catal.*)

*Obv.* King, bareheaded, with curly hair, standing to l. with r. hand offering fruit to a peacock, which stands facing r.

\* The published account does not state whether the horseman is to right or left.

Marginal legend of from 10 to 14 characters, not fully deciphered; see details below.

In variety  $\alpha$  the king stands upright, and the peacock's neck is extended full length.

In variety  $\beta$  the king is stooping, and the peacock's neck is not fully extended.

*Rev.* Goddess, probably Kumári Deví, riding a peacock, holding mace or sceptre in l. hand, and sometimes a fillet in r. hand. Legend, as read by Gen. Cunningham, 'Mahendra Kumára'.\* No mon.

In variety  $\alpha$  peacock is turned to l. and shown in half profile, as is also the goddess; an altar in front of peacock.

In variety  $\beta$  peacock and goddess are facing front, and expanded tail of peacock fills whole field, as in the silver coins; no altar.

| <i>References and Remarks.</i>      | Variety $\alpha$ , king upright; rev. profile peacock, with altar.                                                                                                                                                                                          |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A. A. XVIII, 13;                    | from Swiney coll.; in rev. legend कु 'Ku' ... legible; wt. not stated.                                                                                                                                                                                      |
| B. M., Lind;                        | obv. legend illegible; on rev. 'Śrī ... Ku ...' seems distinct; wt. 128.4; the execution of this coin is very fine and delicate ( <i>Plate IV, fig. 1</i> ).                                                                                                |
| B. M., Nathan;                      | legends not read; coin in good condition, but not so fine as the Lind specimen; wt. 126.5.                                                                                                                                                                  |
| E. C. B. No. 3;                     | found at Jhúsi near Allahabad, along with specimens of $\beta$ variety, and of Kumára's Archer type; in good condition; obv. both l. and r. marginal legend, not read; rev. legend seems to include 'Śrī Kum.'; wt. 128.6. No fillet in r. hand of goddess. |
| A. S. B.;                           | wt. not stated.                                                                                                                                                                                                                                             |
| C.;                                 | one specimen, ploughed up in a field in Allahabad District, with coin of Archer type; wt. 127.60.                                                                                                                                                           |
| A. C.;                              | 1 specimen, found at Allahabad; no further details stated.                                                                                                                                                                                                  |
| Variety $\beta$ ;                   | obv. king stooping; rev., peacock and goddess facing front; no altar.                                                                                                                                                                                       |
| No. 3 of Kumára from Bharsar hoard; | obv. legend read by Kittoe as 'Śrī Kumára,' and rev. as 'Śrīmad Kumára,' but doubtfully; goddess holds fillet and sceptre; wt. 124. ( <i>J. A. S. B. XVI, 397, and Pl. XII, 7.</i> )                                                                        |
| I. O.;                              | wt. 126. ( <i>Plate IV, fig. 2.</i> )                                                                                                                                                                                                                       |
| A. S. B.;                           | wt. not stated.                                                                                                                                                                                                                                             |
| E. C. B. No. 1;                     | obv. marginal legend of 10 or 11 characters, of which second and fourth seem to be respectively त्ति and त्व; rev. legend of 5 characters, the second being कु; wt. 128.2.                                                                                  |

\* I am indebted for this reading to a communication from Gen. Cunningham.

E. C. B. No. 2 ; similar to No. 1, and found with it and No. 3 at Allahabad ; wt. 127·8.

The *rev.* legend, as in the other specimens of both varieties, seems to include कुम 'Kum ...' E. C. B. reads जयति 'jayati' as the first word of the *obv.* legends.

A. G. *obv.* legend 14 characters on right margin only, read doubtfully as . तिचकु [ or क ] ना य

1 2 3 4 5 6

व [ or पु ] रा च . र . . न ; *rev.* legend illegi-  
7 8 9 10 11 12 13 14

ble ; r. hand of goddess empty ; wt. 127·6 ; from Oudh.

A. C. ; 1 specimen, found at Allahabad ; no further details stated. C. ; wt. 127·50 ; obtained at Benares.

The prominence of the peacock in the design of these coins would alone be enough to prove that they must be referred to the reign of Kumāra, and this conclusion is amply confirmed by the legends so far as read. Eight coins of this type, and two of Kumāra's Archer type, were found together at Jhūsi near Allahabad about seven years ago ; three of this trove, as noted above, are in the E. C. B. cabinet, and the remaining 7 coins are in the hands of another collector.

A larger hoard found earlier at Allahabad is noticed in the Introductory Essay.

## KUMĀRA GUPTA MAHENDRA.

### LION-TRAMPLER TYPE.

(*J. A. S. B. XXIV.* 501, class G, var. 1 ; *Rev. Catal.* class K a).

*Obv.* King standing, to r., bareheaded, bow in l. hand, his l. foot trampling on body of lion, which is falling backwards ; no letter before king's face ; legend (in one coin) ... त महेन्द्र जय श्री, ' [aji]ta Mahendra jaya Śrī.'

*Rev.* Goddess seated, facing front, on lion facing r., either holding fillet in r. hand with her l. hand resting empty on hip, or with her r. hand extended empty, and l. hand raised above shoulder, holding lotus-flower ; legend श्री महेन्द्र सिंह, 'Śrī Mahendra Sinha,' or श्री महेन्द्र, 'Śrī Mahendra : ' monogram.

*References and* Variety a. *Rev.* goddess with fillet in r. hand, l. hand resting empty on hip.

*Remarks.* P. E. XXX, 8 ; obtained by Tregear at Jaunpur ; *obv.* legend as given above, the first letter is plainly त as read by Prinsep ; *rev.* legend 'Śrī Mahendra Sinha' ; mon. 8a ; wt. not stated.

Húglí hoard; one specimen; details wanting; rev. legend *Srī Mahendra Sinha.*

*Variety B*; reverse goddess with r. hand extended open, empty; l. hand raised, holding lotus-flower.

A. G.; bought in Bombay; obv. design almost the same as in P. E. XXX, 8; legend illegible; rev. legend श्री म[हेंद्र], 'Srī Ma[hendra?]; mon. 8b wt. 127·2.

The title Mahendra on these coins is sufficient to justify their ascription to Kumāra Gupta. Two coins in A. S. B. cabinet appear to belong to this type; in one the reverse lion faces l., and in the other r., but, in the absence of detailed information, I cannot place the coins definitely.

## KUMĀRA GUPTA MAHENDRA.

### COMBATANT LION TYPE.

(*J. A. S. B. XXIV*, 501, class I; *Rev. Catal.*, class H a.)

*Obv.* King, standing to l., wearing crested helmet or peaked cap and Indian waistcloth, one end of which hangs loose between his legs; his l. hand uplifted; in r. hand he holds bow, having discharged arrow into mouth of attacking lion, of which only the forepart is visible on l. margin. Under king's l. arm कु 'Ku.' Marginal legend of 3 characters on l. margin, viz., रस[or ऋ]म 'ra śa [or śra] ma,' the म 'm' being certain; and 8 or 9 characters in r. margin ending in कु or क 'Ku, or 'Kra,' and beginning with श्री; Prinsep read श्री बल पराक्रमः, but this is not tenable; the letters look like श्री बल पराक्रमः.

*Rev.* Goddess (probably Kumārī Devī) standing, slightly stooping to l., with right hand feeding a standing peacock, which faces r., and with l. hand holding lotus flower. Legend on r. margin कुमार गुप्ताधिराज 'Kumāra Guptādhirāj.' Monogram.

*References* No. 1 of Kumāra Gupta from Bharsar hoard; *obv.* legend not read; *rev.* legend complete; mon. 8a; wt. 124·5 (*J. A. S. B. XXI*, 397.)

### and Remarks.

P. E. XXIII, 28; from Cunningham's collection at Benares; mon. as in Bharsar coin; *rev.* legend imperfect; wt. not stated.

Coin in Swiney coll.; of same type as P. E. XXIII, 28; *obv.* legend indistinct, but guessed by Wilson to be 'Vikrama Sinha'; *rev.* legend 'Kumāra Gupta'; no further particulars stated. (*A. A. p.* 423.)

Coin exhibited at A. S. B.; of *obv.* legend only śra [śrī?] mā on l. margin; 'Srī' on r. margin, and 'Ku' below



arm, legible; *rev.* legend fairly distinct; no further particulars stated. (*Proc. A. S. B. Feb. 1881.*)


I. O.; wt. 126.1; *obv.* legend very imperfect. (*Plate IV, fig. 3.*)

It is to be hoped that some more perfect example of this rare type may be published, so as to throw light on the obverse legend. If Wilson's conjectural reading of 'Vikrama Sinha' on the Swiney coin should be confirmed, the use of the title 'Vikrama' both by Kumāra Gupta and his father would be proved.

## SKANDA GUPTA.

### ARCHER TYPE.

(*J. A. S. B. XXIV, 502, class C 1; Rev. Catal. class E b.*)

*Obv.* King, standing to l., wearing tailed coat, hair curly; l. arm resting on bow; r. hand extended across bird-standard, and holding arrow; under l. arm  'Skanda.' Marginal legend

very imperfect, and not deciphered.

*Rev.* Goddess, seated cross-legged on lotus-seat, holding fillet in right, and flower in l. hand. Legend श्री स्कन्द गुप्तः 'Śrī Skanda Gupta.' Monogram.

*References and Remarks.* P. E. XXIX, 18; Cunningham coll., dug up at a village four kos (8 miles) from Ghāzīpur; mon. 3a; wt. not stated.

P. E. XXX, 10; Tregear coll.; mon. apparently same as in XXIX, 18; wt. not stated.

No. 1 of Skanda from Bharsar hoard; mon. 3b; wt. 129.25; two duplicates weighed 125 each.

No. 2 ditto, ditto; mon. either 3b or 4c; wt. 129.25; "a very perfect specimen; gold indifferent."

No. 3 ditto, ditto; a smaller coin; mon. as in No. 2; wt. 130; a duplicate weighed the same. (*J. A. S. B. XXI, 398—400.*)

I. O., No. 1; mon. imperfect; wt. 129.5.

ditto, „ 2; mon. 8a; wt. 132.5; in *obv.* legend the letters जतम ... 'jatama ...' legible. (*Plate IV, fig. 4.*)

Coin from Mahanada; mon. and wt. not stated. (*Proc. A. S. B. May 1882, p. 91.*)

A. G.; in *obv.* legend जतम 'jamata' seems legible; a letter between king's feet; mon. 3a; wt. 132.3; reverse poorly executed, from Oudh.

B. M. Brind; *rev.* legend imperfect, but the weight induces me to place the coin here; mon. 8b; wt. 130.1.

For 'barbarous' coins of Archer type see Supplement.

## SKANDA GUPTA.

## KING AND QUEEN TYPE.

(J. A. S. B. XXIV, p. 502, class J; *Rev. Catal. class M.*)

**Obv.** Bird-standard, with pennons, in centre of field; king, bare-headed, with curly hair, standing in l. field, facing to r.; queen standing in r. field, opposite to king. King wears either a waistcloth (*dhoti*) or short drawers (*janghiyá*), and armlets, and with l. hand grasps middle of bow, the string of which is turned towards the standard. Queen wears Indian woman's waistcloth (*lahangá*), and in r. hand holds up an object, probably a flower. Legend very imperfect and illegible, but probably consisted of names of king and queen.

**Rev.** Goddess seated cross-legged on lotus-flower seat, holding lotus-flower in l., and fillet in r. hand.

Legend on r. margin श्री स्कन्द गुप्तः 'Śrī Skanda Gupta.' Mon.

**References and Remarks.** B. M.; purchased at Kanauj by Mr. Bacon, and presented to Prinsep; mon. 3a; wt. 128·8. Prinsep erroneously read 'Chandra' on the reverse. This is the coin engraved in P. E. XXIII, 24; and in As. Res. Vol. XVII, Pl. I, 12. (*Pl. IV, fig. 5.*)  
A. S. B.; no details stated.

I have identified the obverse figures as those of the king and queen on the analogy of the King and Queen type of Chandra Gupta I. The name of Skanda Gupta's queen is not known.

## SUPPLEMENT.

Doubtful.

## CHANDRA GUPTA II ?

## ARCHER TYPE.

Obverse and reverse devices as in Archer Type, class II a of catalogue, but execution debased, and weight exceeding 140.

**References and Remarks.** Marsden MLI; in B. M.; च 'Chandra' under king's left arm, with a crescent ॐ over the word; 'bhi' ? between his legs; *rev.* legend seems to be श्री विक्रमादित्य 'Śrī Vikramāditya'; mon. 19a; wt. 148.  
Marsden MLVI; in B. M.; resembles MLI, but *rev.* legend seems to be श्री देव 'Śrī Deva' ...; mon. indistinct wt. 144·5. (*Plate IV, fig. 7.*)  
A. G.; *rev.* legend श्री विक्रम, 'Śrī Vikrama'; mon. imperfect; wt. 144·5; of alloyed metal, from Oudh.

## KUMARA GUPTA MAHENDRA (?)

## ARCHER TYPE.

*Obv.* and *rev.* devices nearly the same as in Archer Type, class I of catalogue, but execution debased. *Rev.* legend श्री महेंद्र, 'Śrī Mahendra'; कु 'Ku' under *obv.* king's arm; wt. exceeding 140.

- References and Remarks.* Marsden, MLII; in B. M.; mon. 8a; wt. 147.0.  
ditto, MLIII; *ibid.*; mon. imperfect; wt. 146.5.  
B. M., Yeames; mon. imperfect; wt. 143.  
" R. P. K.; ditto, do.; wt. 148.7. (*Plate IV, fig. 8.*)  
A. C. XVIII, 23; one of the Kālighāt hoard; supposed by Cunningham (*Arch. Rep. III, 137*) to be a coin of the Kumāra Gupta of Magadha mentioned in the Apsar inscription.  
B. M.; ten specimens, apparently of base metal, and very coarsely executed; av. wt. 148.5; the detailed wts. are — 150.3; 150.2; 147.8; 150.2; 150.6; 147.146.8; 146; 149.2; 147.2.  
A. C.; 2 specimens, no details stated.

Doubtful.

## SKANDA GUPTA KRAMADITYA.

## ARCHER TYPE.

(*J. A. S. B. XXIV, 502, class O 1; Rev. Catal. class E b.*)

Obverse and reverse nearly the same as in the Archer Type of Skanda Gupta already described, but reverse legend is क्रमादित्य: 'Kramādityah,' or 'the sun of power,' and wt. seems to exceed 140.

- References and Remarks.* P. E. XXIX, 17; obtained by Cunningham from Gayá; mon, 8a; wt. not stated; king's body much bent sideways; a curved mark in front of his face.  
P. E. XXIII, 20; given to Prinsep by a lady; king wears a sort of dressing-gown fastened by a sash; no letter between his legs; no crescent under arm; no mon.; some ill-defined marks in right field; wt. not stated; seemingly a rude coin.  
P. E. XXIII, 22; given to Prinsep by Mr. Cracroft; resembles XXIII, 20, but the king's coat is of the usual shape; in both these coins the king stands upright; wt. not stated.  
Marsden MLV; in B. M.; closely resembles P. E. XXIII, 22; crescent between king's arm and name; no letter between king's feet; mon. imperfect; wt. (including attached ring) 150; execution rude.

B. M. Prinsep; resembles Marsden's MLV; mon. imperfect: wt. 141.4. (*Plate IV, fig. 9.*)

A. C.; 2 specimens, no details stated.

The reader may perhaps be surprised at my treating this variety of coins bearing Skanda's name as of doubtful attribution. My reasons are: (1) the heavy wt. of the two coins weighed, which is nearly that of the coins of Nára Gupta and the other imitators of the imperial Gupta coinage; (2) the rude style of the coins; (3) the crescent under the king's arm in the B. M. specimens, as in Nára Gupta's coins; (4) the title 'Kramáditya,' which may be compared with the title Báláditya of Nára Gupta; with Vikramáditya on the rude coin (*Marsden MLI*) bearing the name of Chandra, and with 'Chandráditya,' the title of Vishṇu Gupta (*Thomas, Indo-Scythian coins with Hindi Legends.*)\* It is very unfortunate that we do not know the weights of the coins figured by Prinsep, and only know those coins through the medium of engravings which do not appear to be very good. The B. M. Prinsep coin does not exactly agree with any of the three coins engraved in the Essays. For the present I am disposed to regard this 'Kramáditya' variety of the gold coins bearing Skanda's name as a posthumous issue. It is quite possible that the silver coins of Skanda with the Kramáditya legend may also be posthumous, as some of the silver coins struck in the name of Kumára Gupta appear to be. (*Sir E. C. Bayley in Num. Chron. for 1882, pp. 155 and 156, with references to opinions of Dr. Bühler and Genl. Cunningham.*)

## NÁRA GUPTA BALÁDITYA.

### ARCHER TYPE.

(*Not included in J. A. S. B. XXIV, catal.; nor in Rev. Catal.*)

*Obv.* King to left, bow in l., arrow in r. hand, and bird-standard, as in Archer coins of Chandra Gupta II, but very rudely executed; a letter, which generally appears to be either नी  
'Gu' or 'Śrī,' between king's legs. Under l. arm र; no marginal legend visible.

*Rev.* Goddess on lotus-flower seat, with fillet and flower, very rudely executed; mon. sometimes wanting; legend वासादित्य, 'Báláditya.'

\* The title Vikramáditya is used in the authentic Swordsman and Umbrella gold coins and in some of the silver coins of Chandra Gupta II, but the titles ending in *áditya* appear to have been specially favoured by the princes who issued the rude coins. Gen. Cunningham has two specimens of Vishṇu Gupta's coinage.

*References and* A. A. XVIII, 22; a coin from the great Kálighát hoard found in 1783. See also Records, p. 24.

*Remarks.* Marsden, MLIV; wt. 146·5; probably from Kálighát hoard.

B. M. three specimens in gold; *viz.*, Yeames, mon. 8e; 'Gn' between legs; wt. 148·7 (*Plate IV, fig. 10*):—Prinsep, mon. etc. as in Yeames; wt. 144·5.—A. Newman, as in Yeames; letter between legs imperfect; wt. 143·5.

There are 6 other specimens in B. M., but of base metal. The I. O. collection contains 33 coins of this type, some bearing the name of Nára, and some other names, and all apparently of base metal.

A. G.; from Oudh; mon. apparently 9a; wt. 145·1; metal a pale alloy.

A. S. B.; details not stated.

A. C.; 4 specimens; no details stated.

The historic place of Nára Gupta has not yet been ascertained, but the fact of his coins having formed part of the Kálighát hoard, which consisted entirely of coins of rude and debased style is a strong argument in favour of assigning him a date not earlier than 400 A. D. The companion coin to the Nára figured in A. A. XVIII, 22 is the Kumára coin No. 23 of same plate, which Cunningham attributes to the later Kumára Gupta of Magadha, *circa* 400 A. D. (*Arch. Rep. III*, 137). No. 24 of same plate, from the same hoard is identified by Mr. Thomas as a coin of Vishṇu Gupta Chandráditya,\* a prince of uncertain date, but certainly not included in the list of the imperial Guptas.

Mr. Thomas formerly (*J. A. S. B. XXIV*, p. 386), denounced Nára Gupta Báláditya as "a very ancient myth," and seemed inclined to regard him as an *alias* of Skanda Gupta. In his recent publications, however, he has retracted his former opinion, and now fully admits the separate existence of Nára Gupta, and the reading of his name and title.

Doubtful.

## PRAKĀSADITYA

LION AND HORSEMAN TYPE.

(*Not included in J. A. S. B. XXIV, catal.; nor in Rev. Catal.*)

*Obv.* Horseman wearing cap or helmet, proceeding to r., mounted on a sorry donkey-like animal, thrusting a weapon (short spear or sword), into the open jaws of a lion, or dragon,

\* Indo-Scythian coins with Hindi Legends, in *Indian Antiquary* for Jan. 1883. Nára Gupta's type is again described in same paper.

very rudely designed. Under horse च, 'U ?' ; over horse's head, a blurred letter, or small bird-standard, or three dots. Marginal legend imperfect, and not yet deciphered ; it seems to include विजसत, 'vijasata.'

*Rev.* Goddess, rudely executed, seated cross-legged on lotus-flower seat, with fillet in r. hand, and l. hand holding sceptre (?), or empty.

Legend श्री, 'Sri' and name, see below. Monogram.

*References.* A. A. XVIII, 18 ; *obv.* arrow in horseman's l. hand ; marginal legend illegible ; a character over horse's head ;  
*and*  
*Remarks.* *rev.* sceptre (?) in l. hand of goddess ; legend 'Sri Prakrama Deva' ? (*Wilson*) ; mon. 4 ; wt. not stated.

*ibid. ib.*, 19 ; in *obv.* legend विजय or च 'vijaya' or 'vijasa' legible ; *rev.* unsymmetrical, fillet and mon. wanting ; wt. not stated.

As. Res. XVII, Pl. I, 17 ; from Kanauj ; *obv.* lion not recognized by *Wilson* ; marginal legend of 7 letters on left margin, of which the fourth seems to be न, 't' ; *rev.* as in A. A. XVIII, 18, but mon. wanting ; wt. not stated. A similar coin, perhaps the same, is badly figured in J. R. A. S. III, O. S., p. 382. Nos. 1 and 2 of Sri Prakāsa from Bharsar hoard ; *obv.* lion not recognized by *Kittoe* ; bird-standard over horse's head ; in legend only ज, 'j' legible ; *rev.* goddess' l. hand seems empty ; legend श्री प्रकाश 'Sri Prakāsa' ? ; mon. of both coins 8a ; wt. of No. 1, 146 ; of No. 2, 145 ; gold rich, but workmanship inferior (*J. A. S. B. XXI, 400 ; Pl. XII, 9*).

B. M. 'Pringle ; legends and mon. illegible ; nothing distinct over horse's head ; wt. 136.

B. M. R. S. ; *obv.* bird-standard over horse's head ; legend ... वज ... 'vaja' ... ; mon. 10a ; wt. 145 ; execution fairly good. (*Plate IV, fig. 11.*)

I. O., No. 1 ; *obv.*, three dots over horse's head ; legend lost ; *rev.* well executed ; legend 'Sri Prākāpāche-vah' ? ; mon. 13 ; wt. 145·8. (*Plate IV, fig. 12.*)

I. O. No. 2 ; *obv.* bird-standard over horse's head ; legend न [ or दे ] वजसत ; *rev.* legend as in No. 1 ; mon. three-pronged, imperfect ; wt. 146·2.

A. C. ; 2 specimens, no details stated.

It is difficult to decide on the attribution of these coins. The Bharsar specimens formed part of a hoard of exclusively Gupta coins, and the type resembles the mintages of Chandra Gupta II and Kumāra

Gupta, the only kings of the imperial Gupta line who issued coins with Horseman obverses. The inferior workmanship of these coins, though presumptive, is not *conclusive* evidence of late date, because the undoubted Gupta coins exhibit many degrees of excellence in design and execution. The title on the reverse has been read by Kittoe as 'Śrī Prakāṣa,' and by Wilson as 'Śrī Prakrama' or 'Prakīrti'. Gen. Cunningham informs me that he reads the name as 'Prakāśāditya.' No name resembling any of these forms is a known title of any of the Gupta kings, but the coins might, nevertheless, belong to one of them, for there is no reason to suppose that we have yet discovered all the titles used by those princes. 'Śrī Mahendra' was for a long time regarded as a separate individual, but there is now no doubt that he is the same as Kumāra Gupta; and it is almost equally certain that the name Bakra Gupta, which appears on certain silver coins, is intended for Chandra Gupta Vikramāditya, or Vikrama. The direction in which the horseman is proceeding gives no clue, for left and right horsemen occur both in Kumāra's and Chandra Gupta's coins. The word 'vijaya' which seems to form part of the obverse legend of the coins in question is found on the Midnapur specimen of Kumāra's Horseman to Left type, but does not occur on any coin of Chandra Gupta II. The average weight, 145·6, affords the strongest argument for a comparatively late date, inasmuch as it agrees closely with the weight of the coins of Nāra Gupta Bālāditya, and the other imitators of the imperial Gupta coinage. On the whole, I am disposed to think that these Lion and Horseman coins were struck during the fourth century A. D. by some prince who ruled in the eastern dominions of the Guptas not long after the death of Skanda Gupta, but the question of their proper attribution must remain open pending further discoveries and investigation. It is not improbable that Prakāśāditya was one of the dynasty mentioned in the Aphsar inscription, the princes of which seem to have been descendants of the imperial Gupta family.

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PLATES OF COINS.

*Plate II.*

| <i>Fig.</i> | <i>Reign.</i>     | <i>Type and Variety.</i>         | <i>Reference.</i>                  |
|-------------|-------------------|----------------------------------|------------------------------------|
| 1           | Ghaṭotkacha.      | Solar Standard                   | B. M., Prinsep.                    |
| 2           | Chandra Gupta I.  | King and Queen                   | " purchased.                       |
| 3           | Samudra Gupta.    | Javelin, var. 1                  | " Prinsep.                         |
| 4           | " "               | " " 3                            | " ( <i>obv. only.</i> )            |
| 5           | " "               | " " 4                            | " ( <i>ditto.</i> )                |
| 6           | " "               | Archer, " $\alpha$               | " Eden.                            |
| 7           | " "               | Lyrist                           | " ditto                            |
| 8           | " "               | "                                | I. O.                              |
| 9           | " "               | Aśwamedha                        | B. M., Eden.                       |
| 10          | " "               | Tiger.                           | "                                  |
| 11          | " "               | Boy and Battle-axe var. $\alpha$ | " Bush.                            |
| 12          | " "               | " " " " $\beta$                  | " ( <i>obv. only.</i> )            |
| 13          | Chandra Gupta II. | Couch                            | "                                  |
| 14          | " "               | Archer, class I, $\beta$         | I. O. No. 8; ( <i>obv. only.</i> ) |

*Plate III.*

|    |                       |                              |                                 |
|----|-----------------------|------------------------------|---------------------------------|
| 1  | Chandra Gupta II      | Archer, class II $\alpha$    | B. M., Eden.                    |
| 2  | " " "                 | " " " $\beta$                | I. O., No. 9                    |
| 3  | " " "                 | " " " $\delta$               | " " No. 1 ( <i>obv. only.</i> ) |
| 4  | " " "                 | Lancer, var. $\alpha$        | B. M. Prinsep, No. 1.           |
| 5  | " " "                 | Lion-Trampler, var. $\alpha$ | " " Swiney, No. 5.              |
| 6  | " " "                 | Combatant Lion               | " " No. 4.                      |
| 7  | " " "                 | Retreating Lion              | B. M.                           |
| 8  | " " "                 | Swordsman and Umbrella       | " " Eden.                       |
| 9  | Kumāra Gupta Mahendra | Swordsman                    | " " Prinsep.                    |
| 10 | " " "                 | Archer, class I $\alpha$     | " " Eden.                       |
| 11 | " " "                 | " " class II                 | I. O. ( <i>obv. only.</i> )     |
| 12 | " " "                 | Horseman to Right, $\gamma$  | B. M., Bush.                    |
| 13 | " " "                 | " " Left.                    | " " No. 1.                      |



## Plate IV.

| Fig. | Reign.                     | Type and Variety.                                       | Reference.            |
|------|----------------------------|---------------------------------------------------------|-----------------------|
|      | Kumára Gupta Ma-<br>hendra | Peacock, var. $\alpha$<br>" " $\beta$<br>Combatant Lion | B. M., Lind.<br>I. O. |
|      | Skanda Gupta               | Archer<br>King and Queen                                | " " No. 2:<br>B. M.   |
| 6    | Indo-Scythian              | Shanḍhi branch                                          |                       |
| 7    | Chandra Gupta ?            | Archer                                                  | Marsden MLVI.         |
| 8    | Kumára " ?                 |                                                         | , P. Knight.          |
| 9    | Skanda " ?                 |                                                         | , Prinsep.            |
| 10   | Nára "                     |                                                         | , Yeames.             |
| 11   | Prakásáditya               | Lion and Horseman                                       | , R. S.               |
| 12   |                            | " " "                                                   | I. O. No. 1.          |

## ADDENDUM.

Mr. H. Rivett-Carnac's unique coin of Kumára Gupta Mahendra was accidentally omitted from the Catalogue. The coin was bought at Mathura.

*Obv.* King standing to front, between two standing females: bird-standard over king's right shoulder. To left of king कुमार 'Kumára,' written vertically; on right of king General Cunningham reads 'Gupta,' but the word seemed to me doubtful. Marginal legend illegible.

*Rev.* Goddess on lotus-flower seat, as usual. Legend श्री प्रतापः 'Śrī Pratāpah.' The legend seems to me to be perfectly unmistakable; it is legible even in the poor woodcut of the coin in Proc. A. S. B. Nov. 1883, p. 144. Monogram.

I regard the two female figures as probably intended for the king's consorts, and I have therefore called the type the Two Queens. Dr. Hoernle's suggestion that the central obverse figure is meant for Buddha seems to be quite inadmissible.

The weight of the coin is not stated. The title 'Pratāpa is new.'

*A Paper on the Medals known as Ramtinkis.*—By J. GIBBS, F. R. G. S.,

M. R. A. S., V. P. B. A. S.

(With Plate No. VI.)

In the note I read before the Society in April last on Ramtinkis, I intimated my intention of writing at greater length as soon as I could collect more materials. Since then I have been home and visited the British Museum and made inquiries there, and also from collectors of Indian coins, including Sir Walter Elliot, but regret that I have not been able to add much to the information I already possessed. I unfortunately missed General Pearce who had been for some time in Southern India, and who had made a collection of these medals—but from what I have since heard from Dr. Bidie, I do not think his collection will be found to differ much from my own. Dr. Da Cunha in Bombay has obtained some six or eight, but they all, save one, resemble some of my own specimens, the exception is a small and very much worn specimen which from the hurried glance I was obliged to be contented with, seemed different from any I had met with; it was about an inch or an inch and an eighth in diameter, cup-shaped, but so rubbed that it was almost impossible to make out what was on it. I have since then had four sent me for inspection only, by my friend Rao Bahadur Trimulrao Venkatesh from Dharwar; one of these is a half and the other three are quarter Ramtinkis; they all are of a similar description to the electrotype from Mysore, No. 5 in plate VI; the three quarter pieces were all alike, but two not in such good condition as the third. The following list will show those I have, together with some other varieties I have met with—their weights, diameters, and, in the case of those engraved—the plate and number.

| No. | Description. | Quality of Gold.    | Reverse.                        | Owner.                           | Diameter in inches. | Weight in grains. | Plate.*           |
|-----|--------------|---------------------|---------------------------------|----------------------------------|---------------------|-------------------|-------------------|
| 1   | Double.      | Good.               | Plain.                          | J. P. Watson                     | 2 $\frac{1}{2}$     | 1,485             | Pl. VI.<br>No. 2. |
| 2   | Whole.       | Pale, silver alloy. | Plain.                          | J. Gibbs                         | 2                   | 696               |                   |
| 3   | "            | Very good.          | Hanumán in a rectangular space. | "                                | 1 $\frac{1}{16}$    | 690               |                   |
| 4   | Half.        | Pale, silver alloy. | Plain.                          | Bombay Branch R. Asiatic Society | 1 $\frac{1}{2}$     | 364               |                   |
| 5   | "            | Good.               | Hanumán nearly effaced.         | Name unknown                     | 1 $\frac{1}{2}$     | 349               |                   |
| 6   | Quarter.     | Pale, silver alloy. | Plain.                          | J. Gibbs                         | 1 $\frac{1}{8}$     | 180               |                   |

| No. | Description. | Quality of Gold.    | Reverse.                                                    | Owner.         | Diameter in inches. | Weight in grains. | Plate.     |
|-----|--------------|---------------------|-------------------------------------------------------------|----------------|---------------------|-------------------|------------|
| 7   | Quarter.     | Pale, silver alloy. | Plain.                                                      | J. Gibbs       | 1½                  | 160               |            |
| 8   | "            | Pale.               | Hanumán.                                                    | "              | 1                   | 166               | Pl. No. 4. |
| 9   | "            | Very good.          | Hanumán.                                                    | "              | 1½                  | 160               | " No. 3.   |
| 10  | "            | Good.               | Hanumán.                                                    | "              | 1½                  | 196               | " No. 1.   |
| 11  | "            | "                   | Hanumán.                                                    | "              | 1½                  | 193               | " No. 6.   |
| 12  | "            | "                   | Seated Hanumán in double<br>△ in ○ and<br>□ with ornaments. | Name unknown   | 1                   | 159               |            |
| 13  | "            | Electrotype.        | Hanumán.                                                    | Mysore Museum. | 1½                  | ...               | " No. 5.   |

In Southern India these medals are thus distinguished—

(1.) The whole, or 'Ramtinki Varáha', supposed to be 4 tolas in weight or 720 grains.

(2.) The half or Ramtinki Pratápa, supposed to be 2 tolas in weight or 360 grains.

(3.) The quarter or Ramtinki Dharana, supposed to be 1 tola in weight or 180 grains.

In the following descriptions *obv.* stand for the concave; *rev.* for the convex or back.

No. 1. *Obv.* DOUBLE. Two divisions. *Upper.* Ráma seated with Sítá on his left, umbrella-bearer on his right. Two figures to Sítá's left; sun and moon over Ráma's head; remains of a figure to umbrella-bearer's right and traces of arabesque border.

*Below.* Hanumán in the middle, facing right, traces of a figure to his left; to his right three monkeys, very indistinct. Very coarse work and much rubbed.

*Rev.* Nothing visible. *Much worn.*

No. 2. *Obv.* WHOLE. Four rows of figures. In uppermost Ráma with Sítá to his left. Other figures on both sides but very indistinct. The three other rows contain monkeys; in the centre of the second row Hanumán kneels below Sítá.

*Rev.* Plain.

*This specimen has been much rubbed and battered about having been used for many years in temple worship (see below).*

No. 3. *Obv.* WHOLE. Two rows of figures. *Upper.* Ráma in centre, on his left a standing figure which from

the dress may be Sítá, two more figures, males, to her left; on right of Ráma umbrella-bearer and two other figures. Sun, moon and stars above the figures, an arabesque border and a dotted one above it. *Lower.* Hanumán kneeling on right centre, facing left, a monkey on left centre and figures of men flanking both.

*Rev.* Hanumán standing in centre of a circle which is surrounded with double squares interlaced, which are again enclosed as a circle. Scroll ornaments fill in the interstices. (Pl. VI, No. 2.)

*The work is rather poor, but the medal is in good preservation.*

No. 4. *Obv.* HALF. Three rows in the style of No. 3, but very indistinct.

*Rev.* Plain.

*This has been much rubbed. The late Mr. W. E. Frere, C. M. G. procured it about 35 years ago in the Southern Mahratta country.*

No. 5. *Obv.* HALF. Two divisions, *Upper.* Ráma in centre with Sítá on his left knee. Two figures to her left, the first with a chauri, three figures on the right of Ráma, the nearest holding umbrella. These figures appear as set in a frame with arabesque border at the top. *Lower,* parts of four figures on right of centre. Two, a monkey and a bear on left.

*Rev.* The faintest remains of Hanumán, much rubbed.

*This was sent me for inspection only from Dharwar.*

No. 6. *Obv.* QUARTER. Same design as last, but only one row of figures.

*Rev.* Plain.

*Very much rubbed; similar in work to Nos. 5, 7, 13.*

No. 7. *Obv.* QUARTER. As the last, but position of figures slightly different, more like No. 13.

No. 8. *Obv.* QUARTER. Ráma and Sítá seated on a throne. She on his left. Three figures to her left and four to his right, the first on the left has the umbrella and the first on the right the chowri. Arabesque ornament on edge. Moon and sun over Ráma. Below them in *exergue* Hanumán, under Ráma, and apparently 3 Balbodh letters, but not legible.

*Rev.* Hanumán standing, surrounded by, apparently, an inscription, but the letters cannot be read.

*This is very nearly flat—(Pl. VI, No. 4).*

No. 9. *Obv.* QUARTER. Resembles *obv.* of No. 3.

*Rev.* Hanumán in middle standing in a circle, an inscription round, but not readable.

No. 10. *Obv.* QUARTER. *Upper portion.* Ráma seated on a throne, with Sítá on his right, he has his right arm raised. Three monkeys on his left. Four men on right, the nearest holding the umbrella. Arabesque border. In *exergue* 2 lines of apparently Balbodh letters but imperfectly formed. It has been suggested that they may be intended for ‘

|      |    |    |     |    |     |
|------|----|----|-----|----|-----|
| श्री | रा | म  | प्र | स  | न्न |
| Śrī  | Rá | ma | pra | sa | nna |
|      | १  | ९  | १   |    |     |
|      | 1  | 9  | 1   |    |     |

“Śrī Ráma prasanna ... 191

“May Ráma bless” or “be propitious” ... 191

*Rev.* Hanumán standing in a square within a circle, holding a club with its knob downwards, an inscription in imitation Nagari letters but from which nothing can be made out. (Pl. VI, No. 1.)

No. 11. *Obv.* QUARTER. Similar in style to last, but figures reversed, Sítá and four men on Ráma’s left who has his left hand raised. Umbrella as usual, on right three monkeys. Hanumán very small at Ráma’s feet. In *exergue*, bastard Nagari letters not readable.

*Rev.* Hanumán as in the last, letters on the sides of the parallelogram and outside the circle, but not readable. (Pl. VI, No. 6.)

No. 12. *Obv.* QUARTER. Ráma with Sítá on his left knee, three figures on each side, on Sítá’s left, umbrella-bearer, a man, a monkey; on Ráma’s right, the chowri-bearer, a man, a bear, in *exergue* 4 letters illegible. Florid ornamentation over Ráma.

*Rev.* Hanumán seated in middle in a double triangle in a circle and that again in squares, ornaments of dots and marks in the corners all enclosed in another circle.

No. 13. *Obv.* QUARTER. Ráma and Sita. Three men to his right, two to her left. Grotesque monkeys below.

*Rev.* Hanumán with an illegible inscription round him. Very imperfect. (Pl. VI, No. 5.)

*This is an electrotpe from one in the Mysore Museum.*

The story on them all, illustrated to a greater or less degree, is that of Ráma and Sítá, on their reconciliation and her having proved her purity after being seized and taken off to Lanka by Rávana, and is taken from the Rámáyana. The rows of figures are composed of men and monkeys, the latter forming part of the army of Hanumán by whose means Sítá was rescued. In all the large ones, Hanumán is represented standing or kneeling in the centre of the row below Ráma and Sítá, and holding up a flower to them: in the smaller, he alone sits just below Ráma and his consort. Sítá in some is represented on Ráma's lap, in others seated by him on the *gadi*; the attendants have chowries and the umbrella. The monkey in the same row with Ráma and Sítá is Sugriva the king of that tribe to whom Hanumán was adviser. In some the figure of a bear appears; this is intended to represent Jambavat, the king of the bears, who with his army also aided Ráma in his attack on Lauká.

As none of these medals have any dates or any legible inscriptions, the determination of their age becomes a matter of great difficulty. From all I have been able to learn these pieces were never used as coins. At first, finding that there were 3 sorts, whole, half, and quarter Ramtinkis, and that the weight of each sort was in correct proportion to the others, I was inclined to think they might have been coins, but I have now come to the conclusion that they are medals struck apparently for purely religious purposes. They are highly venerated in Southern India and most families of respectability there have one or more; they are also kept in temples and used in the daily worship. They have been known for very many years, and in the absence of any actual evidence of their date I have been led to seek for any traditions which may exist, and the following has come to me from a trustworthy source.

In about the 9th century A. D., there flourished a famous Reformer of the Saiva sect named Sankarácárya, who travelled about the country chiefly in Southern India and founded '*maths*' or hermitages in various places; amongst others at Sringeri near the source of the Toombudra river, Koodalji in the Holchonor Taluka of the Seomoga division, in the Mysore territory, Sunkeshwar in the Chikkodee Taluka of the Belgaum Collectorate, Humpi in the Hospet Taluka of the Belary District, and some in Gujarat, one of which was I believe in Surat. In the course of time the subordinate Swamis became independent, and some of them very rich. The last Swami but one of Koodalji was one of these, and had a gold throne on which he sat to receive his disciples and followers. It was customary among these followers to make large gifts to the shrine, in which were idols, images of Ráma, Krishna, Siva, &c., which, as well as the apparatus for performing the worship, were

made of gold or silver—and part of the worship consisted in bathing the idols daily in milk, curds, ghi, sugar, honey, fruits, and then in water, after which they were bathed in gold, which is done by pouring over them handfuls of gold coins such as Ramtinkis, Huns and other Hindu coins; these coins are kept specially for this use and are deemed to be sacred, and although as a favour they may be shown to Europeans, none can touch them but the priests.

I do not know how it came about, but the later Swamis at Koodalji lost much of their property, and during the famine of 1876-77 disposed of the remainder of these treasures, and amongst other things mortgaged three Ramtinkis—which according to tradition had been handed down from Swami to Swami from the foundation of the '*math*' in the 9th or 10th century A. D.—to a banker, with the stipulation that if not redeemed within six months they should become his property: the time elapsed, and a year or so after my old friend Rao Bahadur Trimulrao, who was connected by marriage with the banker, heard of them and purchased them for me. They are those numbered 2, 6, 7 in the above list. They have been much knocked about from temple use, the large one especially; they are highly alloyed with silver, and are in consequence very pale in colour. The largest is a whole Ramtinki and has rather the look of having been cast, not struck. Nos. 6 and 7 are quarters and one of them is almost exactly similar to the electrotpe from the Mysore Museum, specimen No. 13.

If we can trust the tradition above alluded to, these medals may be 800 or 900 years old, and the similarity between No. 6 and No. 13 would point to an early date also for the original of the latter.

With regard to the other varieties, I can form no opinion as to their real age, but I am inclined to consider all but No. 8 modern, that is not over 100 to 150 years; one exactly resembling No. 6 was shown me by a Bráhmaṇ in Poona, who said he knew it had been worshipped in his family for over 70 years, and might have been for a far longer time.

The large double one No. 1 is of very coarse work, but of pretty fair gold, it is much rubbed and belongs to Mr. J. P. Watson in Bombay.

I classify the medals I have met with in 3 descriptions:

- a. Those of very pale gold heavily alloyed with silver.
- β. Those of pure gold or nearly so with very fine work.
- γ. Those of pretty good gold and coarser work.

Under α come Nos. 2, 4, 6, 7

„ β „ Nos. 3, 9,

„ γ „ Nos. 15, 10, 11, 12

No. 8 varies from all, being of pale gold but fine work.

From the many inquiries I have made from natives regarding these medals, I have invariably found that they consider the paler gold the more ancient.

When I was in Poona some 6 or 7 years ago, the chief Sankarā-chārya passed through on one of his religious tours, and hearing that he had with him a remarkable Ramtinki I paid him a visit; he was a particularly pleasant spoken gentlemanly person, and had his gold shrine set with rubies and emeralds valued at 2 lacs of Rupees erected for my inspection, and also many of the jewels of his '*toshakhana*' set out; on my asking for the Ramtinki, a priest produced a box wrapped in several covers, and after opening cover after cover a bundle was taken out in which on being opened, appeared the Ramtinki; the priest took it in his hand and held it for me to look at, and it was very like No. 2 in the above list, but I think rather larger, and had 5 rows of figures; it was of pale gold and remarkably deeply cup-shaped, it had evidently been much used and was therefore rubbed and knocked about. I could not get its weight or its diameter; so I had to trust to my eye to assess them.

Dr. Bidie of Madras has sent me drawings of several in the Madras Museum.

The following is a description of them:

No. 1. *Obv.* WHOLE. *Flat.* *Upper.* Rāma and Sítá seated with six figures in two rows on each side. *Lower.* Hanumān in middle standing, indistinct figures on each side of him.

*Rev.* 2 Interlaced squares with ornaments in the interstices with a lozenge-shaped centre, round which appear unformed letters. The subject in the lozenge is not traceable. Wt. 677·3 grs. Diam.  $1\frac{1}{8}$  in. Madras Museum.

No. 2. *Obv.* QUARTER. *Flat.* Two figures on a platform in the middle, umbrella over them, a figure on left with a Lion rampant below it, ornaments and apparently letters.

*Rev.* *Upper.* Eight figures in a row, each holding a lance with a wreath or a torch on it.

*Lower.* Marks which are said to resemble part of the Muhammadan creed and the word "*Sindhya*." Wt. 189·2 grs. Diam.  $1\frac{5}{8}$  in. Madras Museum. *Very rude work.*

No. 3. *Obv.* QUARTER. *Flat.* Much the same as *obv.* of No. 2, no lion but a monkey on left.



*Rev.* Four figures on a platform with their left hands raised, an umbrella in centre, arabesque border. Wt. 160.4 grs. Diam. 1 inch. Madras Museum. J. Gibbs.

No. 4. *Obv.* WHOLE. Very similar to that of Pl. VI, No. 2.

*Rev.* Hanumán standing in a circle which is enclosed in interlaced squares with ornaments in corners. Wt. 662.7 grs. Diam.  $2\frac{1}{16}$  in. Madras Museum.

No. 5. *Obv.* DOUBLE (?) Somewhat similar to No. 4, but work rather more in relief.

*Rev.* 5 lines of what appear to be unreadable letters divided by bands of ornament. This belongs to a banker at Vellore, who gives its weight at 30 pagodas: a pagoda is said in the money tables to weigh  $52\frac{1}{2}$  grs., if this is correct the piece must weigh  $52\frac{1}{2} \times 30 = 1,575$  grs. or more than double a single Ramtinki.

Nos. 2 and 3 of these are not in my opinion Ramtinkis, they are, I believe, specimens of the modern medals struck at some of the great places of pilgrimage in Southern India. One similar to No. 2 was described and depicted in the Proceedings of this Society for 1882, having been exhibited by General Pearce. I have one which resembles No. 3, having only four figures on one side, but having on the other two standing figures on a sort of dais with a man on the right and a monkey on the left.

I have seen several of this latter description: they are of very inferior workmanship, and of no pretensions to age. Mr. Scott at Tanjore showed me one he had, and I have seen another in the possession of a native gentleman at Calcutta, who looked upon it as an object of great veneration, and paid a very large sum for it. It has the same device as No. 3, but was of even rougher work and exactly similar to Mr. Scott's.

I must not conclude this paper without alluding to Marsden's notice of these medals. He appears only to have seen quarter Ramtinkis and those in the illustration in Pl. XLVIII are of the ordinary descriptions. These, as all his other coins, are now in the British Museum, where, until the Chief of Vinchore, at my suggestion, sent home a whole Ramtinki, they had none but quarters in the collection, the one sent home was a duplicate of No. 2 in Plate VI.

I consider these medals to have been struck as votive offerings, their weight varying perhaps in accordance with the wealth or status of the donor or donee. I regret I have not been able to get more accurate information regarding them, but I trust that this article with its illustrations may lead to the Society or myself obtaining further information on the subject.

*On the Geography of India in the Reign of Akbar.*—By JOHN BEAMES,  
B. C. S. (With a Map.)

**No. I. Subah Avadh (Oudh).**

The object of this series of papers is to reconstruct as far as possible the map of the Mughal empire at the time of the first great settlement of the financial and political administration effected in A. D. 1582 by Rájá Todar Mal.

The details of this important operation—the basis of all subsequent settlements—are preserved to us in the *Ain-i-Akbari*, the Persian text of which has been fixed and published by the late Professor Blochmann. He did not live long enough to translate the whole work, and as the valuable notes which he had collected for the second volume, (in which the details of Todar Mal's settlement are given), have been lost; the greater portion of the work has to be done over again. The continuation of the translation has been entrusted by the Society to other hands, and I therefore refrain from encroaching on that ground. But I presume there is no objection to my extracting from the Persian text such details as are necessary for my purpose and supplying such comments as may be required for their elucidation. There is room for many workers in the vast and as yet imperfectly explored mine of the *Ain*. On the present occasion I shall confine myself to geography, reserving for a larger work on which I am engaged references to the Muhammadan historians and other authorities.

The dominions which Akbar either ruled, or claimed to rule, were divided, as we learn from the *Ain*, into twelve provinces, to which His Majesty gave the name of *Súbahs*. These were

|           |            |           |         |
|-----------|------------|-----------|---------|
| Iláhábád. | Ajmír.     | Bangálah. | Láhor.  |
| Agrah.    | Ahmadábád. | Dilí.     | Multán. |
| Avadh.    | Bihár.     | Kábul.    | Málwah. |

to which were subsequently added three more, *viz.* :—

|        |           |             |
|--------|-----------|-------------|
| Birár. | Khándesh. | Ahmadnagar. |
|--------|-----------|-------------|

making a total of fifteen.

Abul Fazl gives a chapter to each Subah, and takes them in geographical order, beginning with Bangálah (Bengal) in the extreme east, and going westwards. I have departed from this order for the following reasons.

The Subah of Bangálah is by far the largest of all, and as it was not at the time of Todar Mal's settlement actually under the sway of the

Dehli emperor, the details given in the *Ain* are less full than those of other Subahs. Moreover, owing to various causes which I need not explain in this place, the changes that have occurred since the sixteenth century are more numerous and perplexing than in any part of India. For Bengal we have some of Blochmann's work, a general sketch of the extent and position of the nineteen sarkárs, and detailed identification of two or three of them.\* I am now engaged in working out the rest, but I am not yet quite ready with Bengal, and though I have received much assistance from the Collectors of the various districts—which I take this opportunity of gratefully acknowledging—I fear some time must elapse before the whole sarkár will be fully reconstructed.

Bihár was not undertaken by Blochmann, but I have nearly finished my identification, and hope to publish it shortly.

Pláhábád, Agrah, Dihli and all those parts of Subahs which were included in the North West Provinces in 1844 have been worked out by Sir H. Elliot and may be found at Vol. II, p. 82 of his *Races of the N. W. P.* (my edition) and those parts left untouched by him I am now working out.

Under these circumstances I have thought it better to begin with Oudh, as I have been able to complete my work on that Subah. Oudh was not British territory when Elliot wrote, and he has therefore omitted it from his lists, with the exception of Gorakhpur, which has all along formed part of the N. W. P.

The materials which I have used are chiefly the reports of the recent settlements of the various districts, supplemented by much valuable information scattered here and there in the *Oudh Gazetteer*. The settlement reports being official publications are not generally accessible to the learned public either in India or Europe, they contain much curious and useful information, and in respect of the old names of estates and parganahs give data not usually procurable, being derived from local tradition, the histories of the great families, and the records preserved by the Kánungoes or fiscal recorders, an office founded by the Mughal Emperors and which has survived to our own times. I have thought it might be serviceable to students to publish in the Society's Journal material at present virtually buried in the Settlement Reports, and to bring together into one general view the scattered notices to be found in the *Gazetteer*. The accompanying map is an attempt at making our knowledge of the subject precise and definite.

\* See his articles on the Geography and History of Bengal in J. A. S. B. Vol. XLII, p. 209; Vol. XLIII, p. 280; Vol. XLIV, p. 275 and in Appendix to Hunter's Statistical Account of the 24 Parganas District.

### I. Sarker Avadh.\*

- 21 mahals. Area 2,796,206 bighas 19 biswas. Revenue 40,956,347 dams nakdí, 1,680,247 dams sayurghál. Castes various. 1,340 cavalry, 23 elephants, 31,700 infantry.
1. Avadh bá havelí. 6 mahals. 38,249*b.* 17*b.* 2,008,366*d.* 1,58,741*s.* Brahmans and Kunbis. 50 horse, 500 foot.
  2. Amboḡháh. Has a fort of burnt brick 2,82,097 bighas, 1,298,724*d.* 7,318*s.* Bais. 30 horse, 700 foot.
  3. Ibrahímábád. 19,338*b.* 8*b.* 445,417*d.* 103,806*s.* Ansáris.
  4. Inbonáh. Has a fort of burnt brick. 74,090*b.* 126,847*d.* Chauhan recently converted to Islam (nau muslim). 100 horse, 2000 foot.
  5. Pachchhimráth. 289,085*b.* 1,217,104*d.* 38,885*s.* Rajputs of the Báchhil and Gahlot clans 20 horse, 500 foot.
  6. Bilahrí. Has a fort of burnt brick. 15,859*b.* 815,831*d.* Bachgotis. 50 horse, 2000 foot.
  7. Basoḡhí. 31,188*b.* 505,473*d.* 1,500*s.* Bachgotis. 20 horse, 500 foot.
  8. Thána Bhadánw. 8,703*b.* 2*b.* 427,509*d.* 36,172*s.* Bachgotis. 1000 foot.
  9. Bakṡháh. 11,101*b.* 385,008*d.* 3,960*s.* Bachgotis. 500 foot.
  10. Daryábád. Has a fort of burnt brick. 487,014*b.* 5,369,521*d.* 226,871*s.* Rajputs of the Chauhan and Raikwar clans. 100 horse. 2000 foot.
  11. Rudaulí. Fort of burnt brick. 351,533*b.* 3,248,680*d.* 249,083*s.* Chauhan and Bais Rajputs. 50 horse, 2000 foot.
  12. Sailak. Fort of burnt brick. 571,071*b.* 4,723,209*d.* 200,945*s.* Raikwár Rajputs. 100 horse, 2000 foot.
  13. Sultánpúr. Fort of burnt brick. 75,893*b.* 3,832,530*d.* 98,967*s.* Bachgotis. 300 horse, 8 elephants, 7000 foot.
  14. Sátánpúr. Fort of burnt brick. 80,154*b.* 1,600,711*d.* 109,788*s.* Bais converted to Islam Bachgotis, Joshis (?). 300 horse, 4000 foot.
  15. Sabihah. 104,780*b.* 1,609,293*d.* 87,200*s.* Rajputs. 30 horse, 1000 foot.
  16. Sarwápálí. 58,170*b.* 1,210,335*d.* 48,107*s.* Bachgotis. 1000 foot.

\* Translated from the Persian text of the *Ain-i-Akbari*, Blochmann's Ed. Vol. II, p. 435.

17. Satrikh. 37,041*b.* 11,26,295*d.* 92,695*s.* Ansáris. 20 horse, 1000 foot.
18. Gúárichh. 79,158*b.* 3,773,417*d.* 3,782*s.* Raikwárs. 50 horse, 1,070, foot.
19. Kishní. Fort of burnt brick, 25,674*b.* 1,339,286*d.* 123,847*s.* Rájputs, 3 elephants. 1,500 foot.
20. Mangalsí. 116,401*b.* 1,360,753*d.* 86,504*s.* Sombansis. 20 horse, 1000 foot.
21. Naipur. 5,997*b.* 308,788*d.* 2,945*s.* Castes various. 500 foot.

[NOTE. In the above list the name of the mahal (*i. q.* 'parganah') comes first, then the cultivated area in bighas and biswas. Next the revenue in dams (40 = 1 akbarshahi rupee) then the "sayúrghál" or rent-free lands;\* then the prevailing caste or clan of the inhabitants, and the contingent of troops both horse and foot. The abbreviations are explained by this note.]

Of these 21 mahals those numbered 1, 4, 5, 7, 10, 15, 17, 18, 20, are still in existence under the same names and probably with nearly the same boundaries as in Akbar's time.

The following require some explanation.

2. Amboḍhá, now written Amorha, is on the left bank of the Ghogra and is now in the district of Basti in the N. W. Provinces. In the Gonda S. R.† p. 11 it is said to have included Bámhanípáir, but this is a mistake as "Bambhanpárah" occurs in the Aín as one of the mahals of Sarkár Gorakhpur. Amboḍhá, however, appears to have included the southern part of the present parganah of Nawábganj on the left bank of the Ghogra facing the city of Ajodhya.

3. Ibrahimábád is now only a village in parganah Satrikh. O. G. ii. 85.

6. Bilahri is now the northern portion of parganah Sultanpúr and is called Baraunsa, see below No. 13.

8. Appears to be now known as Tappah Asl. O. G. iii. 457 where there is a partial reconstruction of this and some other sarkars taken from the Sultanpúr S. R. by Mr. A. F. Millett, C. S. I have followed this officer's guidance almost entirely, as far as it goes.

9. Bakṭahá is not traceable. Mr. Millett says it is now Baksaha in Bára Banki district, but this latter is not mentioned either in the Bara Banki S. R. (which is meagre on this subject) or in the O. G.

11. Rudauli is still in existence but is smaller than in Akbar's time, when it included the present Khandansá parganah to the south-east.

\* See Blochmann's Translation of the Aín, p. 268.

† S. R. stands for Settlement Report, O. G. for Oudh Gazetteer.

12. Sailak presents some difficulty. In O. G. i. 92, it is said to have comprised the present parganahs of Bado Sarái, Ramnagar and Muhammadpur, as well as a tract described as Lálpur-Rámpúr-Mathurá, which probably is on the tongue of land at the junction of the Ghogra and Chaunká rivers now in South Kundri parganah. But if this is correct it is difficult to understand where to put the Bhिताuli parganah of Sarkár Lakhnau. Either Sailak must have consisted of two parts, one (Bado Sarai) lying to the south of Bhिताuli, and another consisting of the remaining parganahs to the north of it, or else Bhिताuli must have been cut in two by Sailak. In the map I have adopted the latter supposition which seems more in accordance with the history. The two parganahs of Bhिताuli and Sailak are, however, very much mixed up throughout the Muhammadan period, indeed they are occasionally spoken of as identical, and I shall be glad if any local officer will throw some light on the subject. Unfortunately the author of the Bára Banki S. R. omits all historical and geographical details, and the *Gazetteer* does not supply the omission. The portion of this Subah which is included in Bára Banki is consequently the most difficult of all to restore.

13. Sultánpúr was that part of the present parganah of that name which lies on the right bank of the Gumti, that part which is on the left bank was formerly known as Bilahri (see No. 6) a name which includes also Baraunsá. The southern portion is known as Sultánpúr Miránpúr or Kathot, a name not found in the Aín.

14. Sátánpur and Kishni (No. 19) now compose parganah Jagdispúr in Sultánpúr district.

16. Sarwápáli is now Amsin in Faizabad district.

19. See No. 14.

21. I cannot find this place. Mr. Millett in his valuable reconstruction of this Sarkár has omitted Nos. 20 and 21. In O. G. i. 462 it is said to be the same as Itifátganj, but the position of this place is not indicated.

Three modern parganahs in this part of the country (Bára Banki again!) are obscure.

i. Mawái Maholará. This seems from O. G. ii. 494 to have been created out of parts of Rudanli and Basorhi, and I have accordingly in the map divided it between them.

ii. Surajpúr. Lies between Daryábád of Sarkar Audh and Sidhaur of Sarkár Lakhnau. In the O. G. in two places (iii. 332, and iii 447) it is said to have been in existence under that name in the time of Akbar, but it does not occur in the Aín. It appears to have been included under Daryábád and I have while waiting for further information shown it so in the map.

iii. Patáhgánj. This is admittedly a modern parganah, and I have

included it under Satrikh, the area of which seems to be considerably smaller now than it was under Akbar.

The Sarkár of Avadh or Audh, as thus reconstructed, was a tolerably compact tract of about 90 miles in length lying principally on the right bank of the Chauká and Ghogra, but including also a strip of varying width on the left or northern bank of the latter. The breadth varies very much, and owing to the want of details for Bára Banki cannot be exactly stated. At its north-western end it is much mixed up with parts of Sarkárs Lakhnau and Bahráich, and two detached portions of the former Sarkár, one consisting of parganah Siddhaur, the other of parganahs Isauli and Garh Amethi, are included in it on its south-western side. On the south it marches with Sarkárs Mánikpur and Jannupúr of the Subah of Iláhábád.

In the endeavour to depict accurately the exterior and interior boundaries I have felt this difficulty that though parganahs bearing the same names as these in the Aín are still extant, it is far from certain that the boundaries were the same as now. The areas given in the Aín only refer to cultivated land, and the exact size of Akbar's bigha is somewhat uncertain. The map can therefore only claim to be an approximation, though probably a very close approximation, to the actual facts of A. D. 1582.

## II. Sarka'r Gorakhpur.

Twenty-four mahals. 244,283*b.* 13*l.* 11,926,790*d.* 51,235*s.* Castes various. 1,010 horse, 22,000 foot.

1. Atraulá. Fort of burnt brick. 32,052*b.* 1,397,367*d.* 6,935*s.* Afghan Miánas. 50 horse, 1,500 foot.
2. Anhaulá. 4,114*b.* 17*l.* 201,120*d.* 2,170*s.* Bisens, horse. 400 foot.
3. Bináikpúr. Fort of burnt brick. 13,857*b.* 7*l.* 6,00,000*d.* Surajbansí Rajputs. 400 horse, 3000 foot.
4. Bámbhanpárah. 6,688*b.* 414,194*d.* Rájput. 2000 foot.
5. Bhanwáparah. 3,105*b.* 15*l.* 155,900*d.* Bisens. 200 foot.
6. Tílpúr. Fort of burnt brick. 9,005*b.* 17*l.* 4,00,000*d.* Súrj-bansí Rájputs. 100 horse, 2000 foot.
7. Chilúparah. Fort of burnt brick. 6,036*b.* 14*l.* 289,302*d.* Rájputs. 2000 foot.
8. Daryáparah. Fort of burnt brick. 31,357*b.* 19*l.* 1,517,078*d.* 5,067*s.* Bisens. 60 horse, 400 foot.
9. Dewáparah and Kotlah. 2 mahals. 16,194*b.* 17*l.* 717,840*d.* Bisens. 20 horse, 2000 foot.
10. Rihlí. 33,183*b.* 19*l.* 1,618,074*d.* 20,873*s.* Bisen Rájputs. 1000 foot.

- 11 Rasúlpúr and Ghausí 2 mahals 4,200*b* 622,030*d*. Sombansis.  
500 foot
- 12 Ramgarh and Gaurí 2 mahals 10,726*b* 485,943*d*. Sombansis Included in Bináikpúr
- 13 Gorakhpúr bá havelí Has a fort of burnt brick, on the banks  
of the river Ráptí 12,656*b* 567,385*d*.  
391*s*. Súrajbansis 40 horse, 200 foot
- 14 Katihlá Fort of burnt brick 900*b*. 12*b* 40,000*d* Bisens.  
300 horse, 200 foot
- 15 Kihlápárah Fort of burnt brick 16,012*b* 425,845*d*. Bansis  
(?) 20 horse, 300 foot
- 16 Mahaulí Fort of burnt brick 2,523*b* 617,256*d* Bisens, 2000  
foot
- 17 Mandwah 1,909*b* 19*b* 452,321*d* Sombansis 20 horse, 500  
foot
- 18 Mandlah 1,252*b* 6*b* 51,100*d*
- 19 Maghar and Ratampur 2 mahals Fort of burnt brick 26,062*b*  
1,352,585*d* 16,771*s* Bisn and Bais 2000  
foot

The above list is taken from the Persian text, and differs in some particulars from Elliot's (Races of N W P Vol II, p 119) It also gives the area and revenue and other details omitted by Elliot The following remarks are necessary for its elucidation

1. Atiaulá The correct name is Uti ulá or perhaps strictly Uttaraulá. Akbar's parganah includes the modern parganahs of Utiulá, Sadullahnagar and Bihaparah on the eastern frontier of the Gonda district (Gonda S R p 11, O G s 1 Utiulá, in 57*k*)

8. Dayápárah is the spelling in the text and no variants are given by Blochmann The parganah which is still extant is, however, now called Dhuriápárah In the map I have given the name as it is in the Persian text, which of course might also read Duryápárah as no vowels are given.

9. Dowapárah and Kotlah So in the text, but Kotlah كوتلاه is an easy and probable mistake for Kohánah كوهانه The real name appears to be Dewápárah Kuhánah which I have shewn on the map after Elliot's explanation It covers all the east of the Gorakhpúr district

10. Ruhlí comprises the northern parganahs of Mánkápúr, Mahádewá and Nawábganj Probably, as suggested under Amorchá in Sarkar Audh, a portion of Nawábganj belonged to that parganah See Gonda S R p. 11.

12. Rámgarh and Gaurí appear to have included all the forest tract north of the Rapti, the northern parganahs of Balrámpúr and Tulsipúr.

15. Kihlápárah may be, as Elliot suggests, a mistake for Ruhlápárah,



an extant parganah. It is no argument against this that to read Rihla-parah would disturb the alphabetical order in which the mahals are given; for I have found a considerable number of such errors in other Subah lists in the Aín.

18. Mandlah cannot be traced.

The remaining mahals of this Sarkár are still extant.

Sarkár Gorakhpúr thus stretches from the Gandak to the Ghogra, and includes the modern Districts of Gorakhpúr and Bastí in the N. W. Provinces and the greater part of Gonda in Audh. The western boundary where it marches with Sarkár Bahraich is however extremely indefinite, and the same may be said of the northern boundary. Even in the present day a very large portion of this tract is covered by dense forests, and this must have been the case to a much greater extent in the sixteenth century. The very small areas given for parganahs which stretch for scores and scores of miles prove this, and historical proofs are not wanting to confirm the impression. Consequently the boundaries of the different mahals in the north of this Sarkár cannot be restored with any approach to accuracy, and I have therefore not attempted to lay them down on the map; this omission is less to be regretted when it is considered that there were certainly no definite boundaries in Todar Mal's time. There were clearings in the forest here and there, which were loosely grouped together under some local name taken from the residence of the Hindu chief or Afghán adventurer who was powerful in those parts. The dominions (if we may use the term) of these chiefs varied constantly as mahals or towns were taken and retaken by contending forces in the petty wars and raids that were constantly going on.

### III. Sarka'r Bahra'ich.

11 Mahals. Area 18,23,235*b.* 8*b.* 2,41,20,525*d.* 466,482*s.* Castes various. 1170 horse, 14,000 foot.

1. Bahra'ich bá havelí. Fort of burnt brick on the banks of the river Saraü. 697,231*b.* 9,139,141*d.* 402,111*s.* Rajputs. 600 horse 4,500 foot.

2. Bahrah. 926*b.* 37,135*d.* Kahnah. 500 foot.

3. Husámpúr. Fort of burnt brick. 157,415*b.* 3,707,035*d.* 1,601*s.*  
Raikwars, Bháles and a sept of Bisens. 70 horse, 900 foot.

4. Dánkdon. 84,436*b.* 440,562*d.* Janwárs. 2,000 foot.

5. Rajbat. 4,064*b.* 11*b.* 166,780*d.* Janwárs. 1000 foot.

6. Sanjhanlí 124,810*b.* 877,007*d.* Janwár Rajpúts.

7. Sultánpúr. 58,140*b.* 166,001. Janwárs. 700 foot.

8. Fakhrpur. Fort of burnt brick. 191,720*b.* 3,157,876*d.*  
56,035*s.* Raikwárs, 150 horse, 2,000 foot.
9. Firozábad. Fort of burnt brick. 108,601*b.* 1,933,079*d.* 4,107*s.*  
Tunwar Rájput. 200 horse, 8,000 foot.
10. Kila' Nawágarh. 417,601*b.* 2,140,757*d.* Various castes.  
50 horse, 1,000 foot.
11. Kahronsa. Fort of burnt brick. 28,489*b.* 17*b.* 1,315,051*d.*  
2,628*s.* Bais. 100 horse, 1,000 foot.

All the mahals of this Sarkár are either still extant under their old names, or distinctly traceable. The Settlement Officer of this district Mr. H. S. Boys, C. S. has effected a very complete reconstruction of the Sarkár accompanied by a clear map. I have filled in the boundaries on my own map from those given by Mr. Boys. One or two points, however, call for notice.

1. The figures for area and revenue given in the S. R. do not agree with those in Blochmann's text. Mr. Boys probably worked on Gladwin's translation which is not always correct. I have given the correct figures above. The mahal of Bahráich included the modern parganah of that name, and Akona (except a small portion north-east of the Rapti) all but 133 villages of Naupára, all but the trans-Rapti portion of Char-da and Bhinga this side of the Rapti.

2. Bahrah included the rest of Bhinga and 77 villages now in Nipál.

3. Husámpúr now known as Hisampúr is still extant, but it was larger formerly, including a considerable tract to the south-east now in the Gonda district, while on the north it included some estates now in Fakhrpúr.

4. Dankdon now called Dángdoi (for which دنگدون in Blochmann's text is possibly a copyist's error) comprised the rest of Akona, the rest of Bhinga, and the northern part of Tulsipúr. Its boundaries were probably never very clearly defined.

5. Rajhat is, all but a few villages, now in the Nipal taráí.

6. Sanjhauli, written by Boys Sijaulí, contained some villages now in Nipál.

7. Sultánpur is an *enclave* in Bahráich and also included a few villages now belonging to Nipál.

10. Kila' Nawágarh. This comprised the modern parganahs of Tambúr, north and south Kundri in Sitápúr and apparently parts of Dhaurahra and Firozábad in Kherí, but its boundaries are not very clear. It seems generally speaking to have occupied the whole Doab between the Kauriala and Chaunká rivers, except a small portion at the extreme south which belonged to Sailak or Bhitauli.

11. Kahronsa is a difficult mahal to restore. The local settlement

officers who have had the advantage of consulting the Kánúgos, the records of the great families, and other local sources of information have been followed in my map, but the exact boundaries for this, as for all parganahs beyond the Ghogra are probably now not determinable.

The Sarkár appears to have occupied all the western portion of the trans-Ghogra country; its boundaries on the Gorakhpúr side are very uncertain. An immense proportion of it was jungle with scattered settlements of Junwár, Raikwár and other Rajpút clans here and there. It stretched far up into the Nipal Taráí and much of it was only nominally under Musalmán sway, the revenue derived from the northern mahals was very small, and the hill chieftains appear constantly to have levied even that. There was also, however, a long narrow slip on the right bank of the Chauka which yielded a much better revenue and was much prized as is shewn by the frequency with which it changed hands under royal grants.

#### IV. Sarka'r Khaira'ba'd.

- 22 mahals. 1,987,700*b*. 6*b*. 43,644,381*d*. 171,342*s*. Castes various.  
1,160 horse, 27,800 foot.
1. Barwar Anjanah. 79,670*b*. 7*b*. 4,325,237*d*. 107,079*s*. Rájputs and Bráhmans. 50 horse, 2,000 foot.
2. Biswah. Fort of burnt brick. 135,119*b*. 3,545,643*d*. 107,916*s*. Báchhil Rájputs. 30 horse, 1000 foot.
3. Páli. 144,627*b*. 1,849,270*d*. 37,945*s*. Ásanín (?). 30 horse, 1000 foot.
4. Báwan. 56,156*b*. 1,161,235*d*. 62,488*s*. Ásanín (?). 20 horse, 1000 foot.
5. Basrah. 60,063*b*. Castes various. 300 foot.
6. Bhurwárah. Fort of burnt brick. 8,971*b*. 18*b*. 435,430*d*. Ahanín (?). 50 horse, 2,500 foot.
7. Bisará. 21,740*b*. 676,066*d*. Báchhils, 200 foot.
8. Pailá. 981*b*. 14*b*. 48,202*d*. Ahanín (?) 200 foot.
9. Chhitiápúr. 64,706*b*. 1,765,641*d*. 41,094*s*. Gaur Rájputs. 50 horse, 700 foot.
10. Khairábád bá Haveli. 2 mahals. Fort of burnt brick. 159,072*b*. 6,161,234*d*. 174,191*s*. Bráhmans, 50 horse, 2000 foot.
11. Sándi. Fort of burnt brick. 211,804*b*. 3,055,339*d*. 195,106*s*. Sombansís. 20 horse 2000 foot.
12. Sarah. 28,832*b*. 2,091,983*d*. 8,666*s*. Chauháns. 60 horse, 500 foot.
13. Sadrpúr. 120,698*b*. 831,175*d*. 15,581*s*. Janwárs and Báchhils, 20 horse, 500 foot.

14. Gopáman. Fort of burnt brick. 1,07,368*b.* 5*b.* 5,620,466*d.* 562,037*s.* Rajputs Kunwar (var. lect. Bisen and Kunwar). 100 horse, 3000 foot.
15. Kherí. Fort of burnt brick. 260,168*b.* 3,250,522*d.* 50,522*s.* Bisen Rajputs and Janwárs. 60 horse, 1,500 foot.
16. Khairígarh. One of the strongest forts in Hindustán, and it has six forts of brick plastered with lime at a short distance from it. 43,052*b.* 7*b.* 1,829,327*d.* Bais, Bisen, and Báchhil and Kahanah (?). 300 horse, 1,500 foot.
17. Kharkhílá. 15,815*b.* 16*b.* 473,727*d.* Ásín (?). 20 horse, 500 foot.
18. Khánkatmau. 3,057*b.* 11*b.* 235,656*d.* Castes various. 400 foot.
19. Láharpúr. 208,288*b.* 3,029,479*d.* 209,079*s.* Bráhmans. 50 horse, 1000 foot.
20. Machhraṭah. 71,069*b.* 2,112,176*d.* 2,430*s.* Báchhil Rajputs. 30 horse, 2000 foot.
21. Nímkhár. Fort of burnt brick. 58,775*b.* 18*b.* 3,566,055*d.* 66,055*d.* Ahirs. 100 horse, 1,500 foot.
22. Hargúnw. 66,952*b.* 200,000*d.* 26,385*s.* Bráhmans. 20 horse, 500 foot.

In this sarkár all the mahals have been identified by the settlement officers of the Hardoi, Sitápúr, and Kheri districts, but nearly all of them call for some explanation.

1. Barwar Anjanalí was a large tract of mostly uninhabited forest country which included the present parganahs of Alamnagar, Pihání-Padaruá in the Hardoi district and Pasgúnw, Mubamdi, Magdápúr, Aurangábád, and Atwá-Pipariá in Kheri. It is said that the second name is properly Anjánah "unknown" so-called from the wild nature of the country, but this is doubtful. It was one large estate held by the Sayyids of Barwar. [In tracing the divisions of Akbar through the pages of the Settlement reports and the *Gazetteer* I have been much impeded by the fact that the writers are all deeply interested in the history of the great proprietary clans and only give geographical notices under those heads, so that one has to hunt up a parganah through a dozen notices.]

3. Páli included the present parganahs of Shahábád and Pachhohá and part of Saromannagar and Katiári.

5. Basrah, was apparently a very small parganah and it is remarkable that no revenue is assigned to it in the text. It is not to be found on the map nor is it mentioned in the O. G.

6. Bhurwárah, a vast and undefined mahal which appears to have included the present parganahs of Bhúr, Haidarabad, Aliganj and per-

haps also Paliá across the Chauká or so much of it as was inhabited at that time. In the north of the Kheri district we get into the jungles again as in Bahráich and exact boundaries are not to be expected.

7. Bisará, there is a small parganah of this name west of parganah Kheri, there is no notice of it in the O. G. unless perhaps it may be alluded to casually in some of the long accounts of Rajpút and other clans of which that work is full, to the exclusion of more precise information.

8. Paila still extant, it included also Karanpúr to the north.

9. Chhitiápúr is the old name of Sitápúr.

11. Sándi appears to have included so much of Katiari as was not in Pali, but where the line is to be drawn is not known.

17. Kharkhlíá, The spelling is that of Blochmann's text, but it appears it should be Karkhila and not Khur. The modern name is Karaoná, and the first syllable is said to be the Sanskrit *kara* = a hand; there is a legend about a Raja who lost his hands and had them restored by bathing in a sacred tank at this place.

18. Khánkhatmau is now in the Farukhábad district of the N. W. P.

21. Nímkhár. There is now no parganah of this name though the ancient and sacred town of Nimkhár or Nimsár is still in existence. This large estate comprised the modern parganahs of Aurangabad, Misrikh, Maholí, Kasta-Abgánw, and Sikandarábád forming a long narrow strip running from north to south in the Sitápúr and Kheri districts.

The remaining parganahs are still extant and probably very nearly their former extent, though there have been here and there a few transfers of villages from one to another.

In Nos. 3, 4, 6, and 17, the ruling clan is given as Ásanín or Áhanín with variants Ásín and Ahín. I would read in all these cases Ahbans. In the Persian character *آسنين* or *اهنين* is very like *اهبنسى* and may easily have been mistaken for it. The Ahbans were a powerful proprietary tribe in western Oudh for many centuries. I am in doubt as to the name *كهنه* in No. 16. It may be for *كهنبى* Khumbí. 'There are one or two parganahs unaccounted for in the Áin. These are:

I. Barwan, between Páli and Sándi. In the Hardoi S. R. p. 95 it is said that Barwan is mentioned in the Áin and the writer gives its area and revenue. I do not know where he got this information as there is no mention of Barwan in Blochmann's text, nor is there any mahal having the area or revenue quoted in the S. R.

II. Chandra. In the Sitápúr S. R. p. 85 it is stated that the old name of this parganah was Haveli. But the Haveli or home county of this Sarkár is Khairabad which is separated from Chandra by Nímkhár and Sitápúr. Some changes of villages from one parganah to another

have occurred since Akbar's time, and it is possible that Chandra may have formed part of the Haveli mahal of Khairabad. I have shewn it in the map as uncertain.

IV. Gundlamau. This parganah is not in the Ain and my authorities give no information on the subject. I presume it was part of the great Nimkhár estate but have shewn it in the map as uncertain.

This Sarkár it will be seen includes the whole of western Oudh. In the southern part the mahals are generally clearly traceable and well defined, but in the north the great submontane forest appears to have been only sparsely peopled and to lay down definite boundary lines on the map would not only be impossible, but would convey an erroneous impression by making precise divisions which were not in existence in the time of Akbar. Kheri on its northern side, Khairigarh and Bhurwára have therefore been left unmarked by boundary lines and I am very doubtful about the northern boundary of Killá Nawagarh and Firozabad which adjoin them.

It only remains to observe that special interest attaches to Láharpúr in this Sarkár from its being the birthplace of the illustrious financier Raja Todar Mal, the author of the great revenue settlement whose features we are now endeavouring to restore.

#### V. Sarkar Lakhnau.

- 55 mahals. 3,307,426*l.* 2*b.* 80,716,160*l.* 4,572,526*s.* Castes various.  
2,680 horse, 36 elephants, 83,450 foot.
1. Abethí. Fort of burnt brick. 117,381*l.* 3,076,480*d.* 3,002,17*s.*  
Ansáris. 300 horse, 20 elephants, 2,000 foot.
  2. Unám. Has a brick fort. 61,045*l.* 2,012,372*d.* 2,537,475*s.*  
Sayyids. 50 horse, 4,000 foot.
  3. Isaulí. Fort of burnt brick on the banks of the river Gúdi.  
1,670,093*l.* 4,208,046*d.* 240,846*s.* Bachgoti  
Rajpúts. 50 horse, 2,000 foot.
  4. Asewan. 57,726*l.* 830,625*d.* 63,421*s.* Bais and Chandel.  
10 horse, 500 foot.
  5. Asoha. 25,027*l.* 509,901*d.* Ahanín (F). 400 foot.
  6. Unchhgánw. 33,122*l.* 417,957*d.* Bais. 100 horse, 2,000 foot.
  7. Bilgránw. Fort of burnt brick. 5,124,113*l.* 356,892*d.* Sayyids  
and Bais. 20 horse, 1,000 foot.
  8. Bangarmau. Brick fort. 242,291*l.* 3,802,122*d.* 151,481*s.*  
Gahlot Rajpúts. 2,000 foot.
  9. Bijlor. 80,581*l.* 2,505,047*d.* 193,961*s.* Chauháns. 30 horse,  
1,000 foot.
  10. Bári. 70,590*l.* 1,284,799*d.* 51,560*s.* Bais. 30 horse, 1,000 foot.

11. Bahrimau. 19,409*b.* 3*b.* 591,406*d.* Bais. 20 horse, 500 foot.
12. Pingwán. 34,727*b.* 420,832*d.* 12,730*s.* Bais. 500 foot.
13. Bithaulí. 8,736*b.* 8,194*s.* 340,191*d.* Rájputs and Jats. 200 foot.
14. Panhan. 8,945*b.* 267,809*d.* Bais. 300 foot.
15. Parsandan. 9,111*b.* 237,537*d.* Rájputs and Khumbís. 200 foot.
16. Páñan. 5,621*b.* 214,255*d.* Bráhmans and Khumbís. 400 foot.
17. Tará Shikaur. 9,357*b.* 123,534*d.* Brahman. 300 foot.
18. Jhalotar. 61,774*b.* 1,123,176*d.* 21,441*s.* Chandels. 20 horse, 2,000 foot.
19. Dewe. Fort of burnt brick. 88,638*b.* 1,933,837*d.* 174,207*s.* Rájputs. 30 horse, 2,000 foot.
20. Deorakh. 13,340*b.* 9*b.* 689,536*d.* Bais. 100 horse, 1,500 foot.
21. Dadrah. 10,796*b.* 73,737*d.* Rájputs. 50 foot.
22. Rambharpur. Fort of burnt brick. 75,490*b.* 2,425,775*d.* 79,225*s.* Bais and Bráhmans. 100 horse, 2,000 foot.
23. Rámkot. Fort of burnt brick. 9,790*b.* 267,099*d.* Rájputs. 200 foot.
24. Sandílah. Fort of burnt brick. 3,937,200*b.* 10,623,901*d.* 837,245*s.* Gahlots and Báchils. 100 horse, 5,000 foot.
25. Sáipúr. 39,083*b.* 15*b.* 2,625,388*d.* 27,736*s.* Chandel Rájputs. 40 horse, 1,000 foot.
26. Sarosí. 25,710*b.* 1,239,767*d.* 1,567*s.* Chandel Rájputs. 20 horse, 1,000 foot.
27. Sátanpur. 60,600*b.* 1,028,800*d.* 10,192*s.* Bais and Brahman. 50 horse, 2,000 foot.
28. Sihálí. 13,065*b.* 694,707*d.* 130,216*s.* Rájputs. 10 horse, 500 foot.
29. Sidhaur. 35,794*b.* 1,692,281*d.* 313,022*s.* Afghans (?) and Rájputs. 100 horse, 1,000 foot.
30. Sidhúpúr. 9,371*b.* 4*b.* 505,018*d.* Bais. 150 horse, 1,500 foot.
31. Sandí. 7,852*b.* 9*b.* 392,313*d.* 13,792*s.* Rájputs. 1,000 foot.
32. Saron. 5,576*b.* 210,316*d.* 2,858*s.* Rájputs and Khumbis. 100 foot.
33. Fatihpur. Fort of burnt brick. 19,830*b.* 3,161,440*d.* Shekh-zádas and Rájputs. 200 horse, 5 elephants, 2,000 foot.
34. Fatihpúr Chaurásí. 105,952*b.* 909,176*d.* 6,594*s.* Rájputs and (!) Chandels. 10 horse, 500 foot.

35. Garh Ambithí. Fort of burnt brick. 47,356*b*. 1,800,000*d*. Bahmangoti Rajputs. 250 horse, 8 elephants, 5,500 foot.
36. Kursi. Fort of burnt brick. 80,817*b*. 1,693,844*d*. 62,919*s*. Rajputs. 60 horse, 3 elephant, 2,000 foot.
37. Kákorí. Fort of burnt brick. 31,574*b*. 1,134,432*d*. 14,430*s*. Bisen Rajputs. 30 horse, 500 foot.
38. Kahanjarah. 22,300*b*. 818,472*d*. Bais. 100 horse, 2,000 foot.
39. Ghátampúr. 27,390*b*. 552,561*d*. Brahmans. 500 foot.
40. Kachh Ando. 22,066*b*. 430,596*d*. 4,460*s*. Chandels. 500 foot.
41. Garandá. 4,803*b*. 334,769*d*.
42. Kúmbhí. 5,940*b*. 267,089*d*. Rajputs. 400 foot.
43. Lakhnau bá Havelí. 91,722*b*. 1,746,771*d*. 241,195*s*. Shekh-zádahs, Bráhmans, and Káyaths. 200 horse, 3,000 foot.
44. Lashkar. 16,794*b*. 167,529. Bais. 4,000 foot.
45. Malihábád. Fort of burnt brick. 169,269*b*. 4,479,250*d*. 108,545*s*. Bais. 30 horse, 2,000 foot.
46. Malúwah. 83,022*b*. 3,598,713*d*. 222,038*s*. Bais. 30 horse, 2,000 foot.
47. Mohán. Fort of burnt brick. 60,990*b*. 1,996,673*d*. 198,484*s*. Bais Rajputs. 30 horse, 2,000 foot.
48. Moránw. Brick fort. 68,847*b*. 1,698,444*d*. 4,806*s*. Bais Rajpúts. 150 horse, 2,000 foot.
49. Madiánw. 49,422*b*. 1,136,613*d*. 32,900*s*. Baswár and Barkalá (?). 30 horse, 500 foot.
50. Mahonah. 50,895*b*. 977,860*d*. 8,805*s*. Rájputs. 50 horse, 2000 foot.
51. Manwí. Fort of burnt brick. 29,500*b*. 771,372*d*. 13,767*s*. Musalmáns and Rájpúts. 2,000 foot.
52. Makráid. 17,959*b*. 576,200*d*. 5,247*s*. Bais Rájputs. 1,000 foot.
53. Hadhah. Brick fort. 11,734*b*. 359,748*d*. 6,026*s*. Bráhmans. 300 foot.
54. Haihar. 13,109*b*. 329,735*d*. Bais. 30 horse, 500 foot.

The greater number of the mahals in this sarkár are still extant and have been identified by Mr. Millett in the Sultanpúr S. R. Those portions which lie in the Bara Banki district present some difficulties owing to the absence of all historical data from the S. R. of that district; the writer of which says he leaves such matters to the compiler of the *Oudh Gazetteer*. The O. G., however, merely copies the scanty notes of the S. R., so we are left in the dark.



1. Abethí is now spelt Amethi. The original word appears to have been Ambishthi which would give either spelling in its Prákrit form. The parganah is now known as Mohamlálganj, the town retains the old name.

5. Asohá is now combined into one parganah with Parsandan No. 15.

6. Unchhganw. This mahal with Tara Singhaur (which appears to be the true reading for Bárá Shikaur of Blochmann's text) No. 17 and Sidhúpúr No. 30, has since Akbar's time been made into the one parganah of Daundia Khera.

7. Bilgránw or -grám is the site of the famous battle in A. D. 1540 where Humayun was defeated by Sher Shah. The mahal included the modern parganah of Bangar. O. G. I. 223.

9. Bijlor is now written Bijnor. The l, however, is right, as the original word seems to have been Bijlipúr.

11. Bahrímau or Pahrímau was the old name of Pírnagar.

12. Pingwán or Bangwán I cannot find anywhere. Perhaps the local officers can enlighten me.

13. Bithaulí. Spelt in the O. G. Bhitauli. The town is on the Doab between the Gogra and Chauka but it is difficult to define the boundaries of this mahal and Sailak in Sarkár Avadh (*vide supra*).

20. Deorakh. This mahal also I cannot find.

21. Dadrah appears to account for a portion of the blank space in the Bara Banki district not covered (as far as can be seen) by any name in the Aín. This space is now divided between the Nawábganj and Partábganj parganahs both of which, however, are of very recent creation.

22. Rambhirpur is now called Purwá, the last half of the old name Rambhirpurwá with the Eastern Hindi lengthened nominative.

23. Ramkot lies all by itself in the middle of Khairábád. This Sarkár has several detached portions besides Ramkot, *viz.*, Garh Amethi and Isauli in S. Avadh, Hardoi in S. Manikpur and perhaps Bithauli in Bahráich.

24. Sandílá appears to have included Bálámau. O. G. I. 209.

25. Sáipur is also known as Safipúr.

26. Saron the old name of Sikandarpur near Unao.

27. Sátanpur the old name of Khiron.

28. Sihali, still a town in parganah Fattihpur of Bara Banki.

31. Sandí, now called Sissaindi, this is probably the proper name for which Sandi is a copyist's error.

38. Kahanjarah, not traceable.

41. Garandá, probably the same as Gundwa or Gondá. The text گوند may be an error for گوند.

42. Kumbhi, not traceable.

44. Lashkar said to be for Nisgarh, which is said to be a well-known village (Sultanpur S. R. s. v.) the position, however, is not stated.

48. Moránw is now spelt Mauránwán, an E. Hindi dialectic form.

49. Madiánw now Madiánwán. This is now included in Mahona.

54. Haihar is not traceable.

All the others are still extant. Modern parganahs not in the Aín, and not clearly identifiable are Nawabganj, Partabganj, Surajpur, and Mawai Maholára, the last of which, however, probably belonged to Sarkár Avadh.

This Sarkár, the richest and most cultivated of the whole, occupies the south-west portion of the Subah with certain outlying patches, and includes within its boundaries the *enclave* of Satrikh.

The Dastúrs, which appear to have been somewhat similar to modern Districts (see Elliot, *Races of N. W. P.*, Vol. II, p. 201) are as follows : (Aín, Text, Vol. I, p. 352.)

Sarkár Avadh. 19 mahals, 2 of which are included in Khairábád.

These two, however, are not specified. All the mahals of the Sarkár except two form the 1st dastúr. Ibrahimábád alone forms the 2nd dastúr, and Kishm alone the 3rd.

Sarkár Bahráich. Firozábád and Sultánpúr 1st dastúr. Kahronsa, 2nd dastúr, and all the rest the 3rd.

Sarkár Khairábád. 1st *d.* Haveli, Bisára, Biswah, Basrah, Chitimpúr, Khairigarh, Sudupúr, Kheri, Karkhilá, Láharpur, Machhrahtá, and Hargau.

2nd *d.* Páh, Barwar-Anjaná, Báwan, Sándí, Sarah, Gopámau, and Nimkár.

3rd *d.* Bhurwárah and Pailá.

Sarkár Gorakhpúr. Constituted one dastúr.

Sarkár Lakhnau. 2 dastúrs. Unám, Bilgrám, Bangarmau, Hardoi, Sultánpúr, Fatihpur-Chaurási, Kachhand and Maláwah form one dastúr, and all the rest the other.

I have excluded from this review all those portions of the present province of Oudh which did not lie within the Subah of that name. These will be dealt with under Subah Iláhábás. They are parts of Rai Bareli, Partábgarh (nearly the whole), Sultánpúr and Faizábád. It will be seen that there are a good number of uncertain points, and my map cannot be accepted as anything but a first attempt. I trust, however, that it will be useful in one way; it is not until you come to construct a

map, and find yourself forced to account for every inch of the tract included, that you find out the gaps in your information. These I have now indicated, and I conclude with again expressing a hope that local officers interested in the history of the province will come forward with information which may clear up all the doubtful points.

*Baiswáří Folk Songs collected by BĀBÚ JOGENDRA NÁTH RAE, Gházípur.*  
(Contributed by W. IRVINE, Esq., C. S.)

[The following songs are composed in the Baiswáří dialect, with a slight admixture of Western Bhojpúrí. They were collected by Bábú J. N. Rae in the town of Gházípur. He says that he took them down, exactly as repeated, from the mouths of women of the lower castes, such as Kalárs, etc. Some songs were obtained from Gáthaks or male professional singers, who recited them, and whose words were taken down. The Bhartharí song was obtained from the dictation of a Gosain mendicant.—The text has been edited by Mr. G. A. Grierson, C. S., who has added a few notes, distinguished by his initials (G. A. G.). The translations have also been amended in several places, where they represented the original either incorrectly or too freely.—Ed.]

## ॥ १ ॥ सोहर गीत ।

१ भउज मे को चूनरी पहिनाव

भइया साहेब मुखऊ न बोले

भउजी ओठ बिजुकाई

गरभ की माती डेहरिया चढ़ि बैठी

ननद लुटन मोहि आई

भउज मे को इत्यादि

२ कठिया घरवनी मै टठिया लेबौ

आँख अँजवनी खोरा

हसन खेलन को मै चेरिया लेबौ

सइयाँ चढ़न के घोड़ा

भउज मे को इत्यादि

NOTE. भउज is more usually भाउज, and is possibly incorrect. चढ़ि is a dialectic form of चढ़ि. G. A. G.

### Translation.

1, O sister-in-law, dress me in a bordered garment.

My brother did not even utter a word [*lit. speak with his mouth*],

My sister-in-law with pouting lips  
And a proud face moved away and sat on the doorway, (saying :)  
“Lo ! sister-in-law is here to rob me.”

O sister-in-law, dress me, etc.

- 2, I shall take a plate as a present for the *Chhath*,\*  
A cup for holding lamp-black for the eyes (of thy babe),  
I shall take a waiting-maid to laugh and play with thy child,  
I shall take a horse for thy husband to ride upon.  
O sister-in-law, dress me, etc.†

## ॥ २ ॥ सोहर गीत ।

नन्द घर बाजे बधइया

मथुरा कृष्ण को जन्म भयो है

गोकुल बाजे बधइया

रानी जसमत जी को ठोटा जनम्यो

सखियन मङ्गल गइया

नन्द घर बाजे बधइया,

NOTE. ठोटा, ‘a little child’, is generally used affectionately to mean ‘dear little child’. G. A. G.

### *Translation.*

Birth-music is being sounded in the house of Nand.

At Mathurá Krish'n is born

And birth-music is sounded at Gokul.

To Queen Jasmat (Jasodá) a son is born.

All the attendant ladies sing songs of jubilee.

Birth-music is being sounded, etc.

The legend of the birth of Śrī Krish'n is so well-known that it requires no notes to describe how he was born at Mathurá and thence

\* A ceremony held in honour of the goddess *Chhath* a month after the birth of a child. It is on this day that the mother leaves the room where she was confined for the period ; she is thenceforth considered as pure and capable of performing all the household duties and mixing freely with the inmates of the house. [The ceremony was originally performed on the sixth day after birth, hence its name. G. A. G.]

† [*Bhāúj* sister-in-law, i. e., brother's wife ; but *nanad* sister-in-law, i. e., husband's sister. The idea of the piece is this : *nanad* goes to visit *bhāúj* on the sixth day after the birth of the latter's son. *Bhāúj* is sulky and says, “*nanad* has come to rob me of my child”. *Nanad* remonstrates and says, she is come to make presents. There is a reference to the proverbial jealousy between sisters-in-law. Each is much displeased when the other has a child, but at the same time she is bound to give the mother handsome presents, in order that when her turn comes, she may get still handsomer ones.—ED.]

transported secretly to Gokul to the house of Nand, how, this precaution was taken in order to save the child from falling into the hands of Kams, the wicked uncle and king of Mathurá, and how his real parents were confined in a black dingy den where the future hero was born.

Sohars are songs that are sung on the occasion of a birth. The women of the neighbourhood all muster together and make themselves jubilant over the interesting occasion. There is no end of *gholaks* (drums) being beaten with all the might of their bravery.

### ॥ ३ ॥ होली गीत ।

- १ पिचुकारिन काहँ को मारि, लजा हो  
रङ्ग की चोट मोहि कारी लगत  
पिचुकारिन काहँ इत्यादि,  
२ भर पिचुकारी मेरे मुख पर मारी  
अँगिया भिजि तन सारी, लजा हो  
रङ्ग की चोट मोहि कारी लगत  
पिचुकारिन काहँ इत्यादि

NOTE. कारी here = भारी, 'severe', of a wound &c. G. A. G.

*Translation.*

- 1, Why dost thou spurt with a syringe? Ho Lalá!  
It strikes hard against me—the liquid red.  
Why dost thou spurt, etc.
- 2, The full syringe thou dost pour on my face—  
My entire bodice and body have got wet, Ho Lalá!  
Why dost thou spurt, etc.

Holí songs are peculiar songs that are sung on the occasion of the celebrated festival known as the Holí which, as is well-known, is solemnized in honour of Krish'njí. [It is rather the festival in honour of the Uttaráyana or Vernal Equinox. G. A. G.]

### ॥ ४ ॥ चइती गीत ।

- १ चइत की चाननि रतियौ  
ए री निरखत भई भोर,  
मेरे रामा हो, चइत इत्यादि  
२ ए री सहयौ मेर चन्दा भइलैं,  
ए री मै तो भइलौ चकोर  
मेरे रामा हो, चइत इत्यादि

NOTE. *र रौ* is an interjection only used in addressing females. The masculine form is *र रे*. The *चकोर*, *chakor*, is the Greek partridge (*Perdix rufa*), which is said to be enamoured of the moon, and to exist on moonbeams and ambrosia. G. A. G.

*Translation.*

- 1, Gazing at the moonlit night of (the month of) Chait,  
It has become well-nigh dawn;  
O my Rámá, gazing at the moonlit night, etc.
- 2, Lo, my husband has become the moon,  
And lo, I have become the *chakor*.  
O my Rámá, gazing at the moonlit night, etc.

## ॥ ५ ॥ चइती गीत ।

- १ ए री तङ्ग भइली चोलिया रामा  
ए री नाजूक बहियाँ ना समाय  
मेरे रामा हे, तङ्ग भइली इत्यादि
- २ सुनु रे दरजिया को झोकड़े  
तू तो निपटे नदान  
मेरे रामा हे, तङ्ग भइली इत्यादि

NOTE. नाजूक is the Persian *نازک* and नदान is *نادر*. G. A. G.

*Translation.*

- 1, Lo, my bodice has become tight, O Rámá,  
It does not fit my tender arms;  
O my Rámá, my bodice, etc.
- 2, Hark, son of the tailor,  
Thou art excessively foolish!  
O my Rámá, my bodice, etc.

## ॥ ६ ॥ कजरी गीत ।

- काहें मेरि सुधि बिसराए परदेसिया  
१ आपु तो जाय बिन्दावन छाए  
खिख खिख जोगपठाए परदेसिया  
काहें मेरि सुधि इत्यादि
- २ आपु तो जाय दारिका बहटे  
कुबरी से नेह लागए परदेसिया  
काहें मेरि सुधि इत्यादि

*Translation.\**

O my beloved, why dost thou forget me in the foreign land ?

- 1, Thou hadst gone and settled in Bindrában,  
And from time to time sendest letters of *jog* from the foreign land.  
O my beloved, why dost thou forget me, etc.
- 2, But now thou hast gone and residest in Dwáriká,  
And makest love with the hunch-backed woman in the foreign land.  
O my beloved, why dost thou forget me, etc.

When Krish'nji left Rádhikáji he went over to Dwáriká and there assumed the title of a king ; there he is said to have fallen in love with a certain hunch-backed woman known in Hindú mythology as Kubjá or Kubrí.\* There is a legend to this effect that by the touch of the divine hands of Krish'nji this ugly creature was transformed into a most beautiful woman of graceful form and figure. In this song Rádhiká alludes to this awkward intrigue of her lover and twits him with his faithlessness.\*

## ॥ ७ ॥ कजरी गीत ।

पुरुष के देसवा से अइलै बनजरवा रामा  
हेरा डाले सुन्दर के अँगनवा रे हरी  
सगरोँ अँगनवा केकेला बनजरवा रामा  
कैसे क बोहारोँ घर अँगनवा रे हरी  
ठारी देख गोँदिया उलाटि देब बखरवा रामा  
निऊरि बोहारोँ घर अँगनवा रे हरी  
अँगना बोहारत मेरा उड़ल अँचरवा रामा  
देवरा पापी निरखै मेर जोबनवा रे हरी  
अइसन देवरवा के फँसिया रे दियौलूँ रामा  
जब रे घरवा हेतौ कूरी बजवा रे हरी

\* [ ' Letters of *jog* ' apparently means letters on the subject of practising asceticism. Mr. Grierson points out a parallel passage in a song of Súr Dás, in which that poet recounts a number of beneficent acts traditionally ascribed to Krish'n, such as his assistance to the Páṇḍavas, his protection of Draupadi, the destruction of Hiraṇyakaśipu, etc. Among them the poet adds : *ápu jái Dwáriká baiṭhe likhi likhi jog paṭhái*. The same statement also occurs in another of Súr Dás' songs, in which Rádhá is represented as complaining about Krish'n that while he himself is indulging in amorous intercourse with Kubrí and the Gopís, he exhorts her to devote herself to the practice of asceticism : *ap ne jái prem ras chákhe ham ko likhi likhi jog paṭhawe*, i. e., ' while he himself is gone (to Gokul) to enjoy the sweets of love, he writes to me to recommend asceticism.'—Ed.]

NOTE. बनिजरवा is long form of बनिजार, 'a merchant'. I would prefer to consider रेऊ in the fifth line, as the 2nd singular imperative. बखरवा is long form of बखार, which literally means 'a granary.' G. A. G.

*Translation.*

From the eastern land came a merchant, O Rámá.  
He took up his lodgings in Sundar's yard, O Hari.  
The merchant has filled up the entire yard, O Rámá.  
How shall I sweep the dust of the yard with my broom, O Hari?  
I will push away the trappings of the oxen and cast away the sacks,  
O Rámá.

And I shall sweep the yard bending myself down, O Hari.  
While sweeping the yard the skirts of my cloth flew away, O Rámá.  
And my wicked brother-in-law began to gaze on my breast, O Hari.  
I would get such a brother-in-law killed, O Rámá.  
If my "knife-thrusting" were at home, O Hari.

"Knife-thrusting" here refers to her husband, because he is her natural protector and as such could deal vengeance.\*

The Kajaris are sung during the rainy season. They were formerly indigenous to Mirzápúr but are now spreading far and wide over the land. The airs of these songs are rather melancholy, though they are tuned to express different feelings and sentiments.

[The name of the song is probably derived from the darkness of the clouds at this season, which are considered to resemble *kújar* or lamp-black collyrium. The well-known author of the treatise called *Hindī Bhāṣhā*,—Bábū Hariśchandra—gives a different account. He says that there was in Central India a famous Rājput prince named Dádú Ráy, in whose time no Musalmán dared touch the Ganges. On a famine occurring in his dominions, he brought rain by the ardour of his devotions. This made him so popular that when he died and his Queen Nág'matī became *satī* with his corpse, the women of the country invented a new melody which was named *Kajalī* to express their sorrow. The author concludes "there are two reasons for the name *Kajalī*;—one, that the king owned a forest called *Kajalī ban*, and the other, that the third of the month on which this song is most sung is called in the *Puráns*, the *Kajjalī tīj*. G. A. G.]

## ॥ ८ ॥ जंतसार गीत ।

१ बारह बरिसवा की मैना रे तिरियवा रे  
तेरहे बरिसवा गोबिन्दा आसिक रे ना

\* [*Chhūrī-baj'wā* is the long form of *chhūrībāj*, a compound of *chhūrī* 'knife' and *bāj* (Persian بای) 'one who is practised in something.'—ED.]



- २ अपने आसुरवाँ मैना भारै लम्बी कसिया रे  
गोबिन्दा सँवारे टेड़ी पगड़ी हो ना •
- ३ मैना जो चले लागी अपने ससुरवाँ रामा  
पिछवाँ रे पिछवाँ गोबिन्दा आसिक हो ना
- ४ फिरि चले फिरि चले गोबिन्दा आसिकवा रे  
सवन भदउवाँ हम चले आइव हो ना
- ५ सवन भदउवाँ की निस अँधिरिया रे  
बिजुली चमके जियरा मारे हो ना

NOTE. आसिक is the Arabic عاشق. G. A. G.

*Translation.*

- 1, The girl Mainá is of twelve years,  
Her lover Gobindá is of thirteen.
- 2, In her parlour Mainá combs her long hair,  
Gobindá adjusts his slanting turban.
- 3, When Mainá was going to her father-in-law's house, O Rámá,  
The lover Gobindá followed close behind her.
- 4, "Go back, go back, my beloved Gobindá.  
"I shall return in Sáwan or Bhádō.
- 5, "The nights of Sáwan and Bhádō are dark,  
"The lightning flashes, and it pierces my heart."

In order to lighten the labour caused by incessant grinding of mill-stones, the women of these parts sing songs in a concert. Two women sit face to face with their legs spread and their arms holding tight the fulcrum of the grinding-stone.

## ॥ ६ ॥ भैरवी गीत ।

- १ सइयाँ दरवजवा ठाड़ि रहँ  
पिया मिलन की भई बेरिया  
दरवजवा इत्यादि
- २ ताव पिया को बेग मिलाओँ  
निकस जात जो हाँ रे पिया  
दरवजवा इत्यादि

NOTE. ठाड़ि is dialectic for ठाड़ि.

*Translation.*

- 1, O my husband, I am standing (waiting) at my door,  
The time of meeting with my dear one has come,  
I am standing, etc.

- 2, Until I am immediately united with my beloved,  
My soul is on the point of forsaking me, O my dear one !  
I am standing, etc.

## ॥ १० ॥ भैरवी गीत ।

- १ रामा ! मोहि कल ना पड़त जिया में  
याद आवे उन की बतिया  
मोहि कल ना पड़त जिया में  
२ कन कन उठतु भरोठे ठाड़ि रे  
पीर उठत हिया में  
कल ना पड़त जिया में

NOTE. कल पड़त usually means 'to sleep.' कल is 'rest', कल ना पड़त is literally 'rest does not fall.' उठतु is an old form of उठत. भरोठ or more usually भरोठ is literally 'a lintel.' भरोठे is locative. G. A. G.

### Translation.

- 1, O Rám, a disquiet comes over my soul,  
When I call to remembrance his words.  
A disquiet comes, etc.  
2, Every moment I get up to stand by the door,  
And a pain rises up in my heart.  
A disquiet comes, etc.

## ॥ ११ ॥ भैरवी गीत ।

- १ नजर लगी रे मो का राम  
चलत अँगनवा मोरे राम  
नजर लगी इत्यादि  
२ अँगिया मसक गई चुड़िया तड़क गई  
गिर गयो हाथे का कँगनवा  
नजर लगी इत्यादि

### Translation.

- 1, O Rám, have any evil eyes fallen upon me  
When I was passing along the yard ?  
Have any evil eyes, etc.  
2, My bodice has got loose, the *churís* (hand-bangles) have been  
shivered,  
The bracelets of my hands have fallen down.  
O Rám, have any evil eyes, etc.

## ॥ १२ ॥ भैरवी गीत ।

- १ पनिघटवाँ रोके ठाड़  
कैसे भरूँ पनिछाँ रे गोइयाँ !  
पनिघटवाँ इत्यादि
- २ एक डर मोहे सास ननद की  
दूजे बैरन मेरी सौतिनियाँ  
पनिघटवाँ इत्यादि

*Translation.*

- 1, He stands obstructing the steps leading to the waters.  
How then, my friend, can I fill my pails ?  
He stands obstructing, etc.
- 2, I am already afraid of my mother-in-law and sister-in-law,  
Over and above are the other wives of my husband.  
He stands obstructing, etc.

## ॥ १३ ॥ भैरवी गीत ।

- १ सइयाँ अँखियाँ नहिँ लागी रे  
समुझि समुझि उन की बतियाँ  
अँखियाँ इत्यादि
- २ आवन कहि गये, अजहँ न आए  
किन सौतिन बेखमाए  
सइयाँ अँखियाँ इत्यादि

NOTE. किन = कौन. G. A. G.

*Translation.*

- 1, Lo, I have not set eyes on my husband,  
And yet full well I remember his promise.  
Lo, I have not set eyes, etc.
- 2, He went away with a promise to come, but up to this day he has  
not come.  
What evil woman has deprived me of him ?  
Lo. I have not set eyes, etc.

## ॥ १४ ॥ भैरवी गीत ।

- १ सइयाँ बलि जाख्योँ मेा से बेलो ना  
तलफ तलफ रैन गुजारी  
सइयाँ बलि जाख्योँ इत्यादि
- २ कदरपिया मै तुम पर बारी  
लपक भपक गरवाँ खागि सोरँ ना  
सइयाँ बलि जाख्योँ इत्यादि

*Translation.*

- 1, O husband I will kill myself, do speak with me.  
I passed the whole night in fits and starts.  
O husband, I will kill myself, etc.
- 2, Says Kadarpiya, I am extremely fond of thee,  
And I wish to fall on thy neck and hold thee tight.  
O husband, I will kill myself, etc.

## ॥ १५ ॥ दोहा ।

नैन नैन के जात है, नैन नैन के हेत ।  
नैन नैन चोरी करत, नैन नैन कहि देत ॥

*Translation.*

The eye goeth to the eye for the sake of the eye.  
The eye stealeth the eye and the eye informs the eye.

## ॥ १६ ॥ दोहा ।

प्रक तो नैना बिख भरे, दूजे अझन सार ।  
अरे बउरी कोइ देत है मतवाले हथियार ? ॥

*Translation.*

Thine eyes are already filled with poison, they are decked with lamp-black over and above.

O mad girl, does any one put a weapon into the hands of a drunken person ?

## ॥ १७ ॥ दोहा ।

अमी, हलाहल, मधु भरे, श्याम, सेत, रतनार ।  
जिअत, मरत, भुक्त भुक्त परत, जेहि चितवत प्रक बार ॥

*Translation.*

(The eye is) full of nectar, poison and wine, like unto a black, white and red (lotus).

He lives or dies or falls a-trembling upon whom it glances but once.

## ॥ १८ ॥ दोहा ।

मन में राखिँ मन जले, (बच) कऊँ तो मुख जल जाय ।

गुङ्गे का सपना भयो, समुझि समुझि पकताय ॥

NOTE. बच in the first line is superfluous, and spoils the metre.  
G. A. G.

*Translation.*

Being kept in the heart, the heart burns; being uttered by the mouth, the mouth burns.

It is just the dream of the dumb; knowing it well, he grieves (because he cannot express it).

## ॥ १९ ॥ दोहा ।

हम जाना तुम कनक है, ता से पहिना कान ।

कसत कसौटी नहि बनी, पीतल भयो निदान ॥

*Translation.*

I thought thou wert gold, hence I put thee on my ears.

It produced no marks on the touch-stone and became only a heap of brass.

## ॥ २० ॥ दोहा ।

कागा चुन चुन खाइयो, (तू) तन कर सारा मास ।

दूने नैन बचाइयो, पिछा मिलन की आस ॥

NOTE. तू in the first line is superfluous and spoils the metre.  
G. A. G.

*Translation.*

(The dead exclaims :)

O daw, thou might'st peck and eat up the entire flesh of my body ;

But pray leave alone these two eyes of mine, for still I have hopes of seeing my beloved.

## ॥ २१ ॥ दोहा ।

पीतम पाती लिखि नहीं, गए बड़त दिन बीत ।

अब से जाना आप को, मुख देखे की प्रीत ॥

*Translation.*

O my beloved, thou hast not written a (single) letter to me, and many days have passed.

Henceforth I understand thee, thy love depends on seeing my face.

## ॥ २२ ॥ दोहा ।

ए नैना ! तोह पटक देउं, (कौ) चूर चूर उड़ जासु ।

काह देख जर मरत, काह देख जुड़ासु ॥

NOTE. कौ in the first line is superfluous. There is a syllable short in the first half of the second line. G. A. G.

*Translation.*

O eye I shall throw thee down, so that thou mightst crumble into pieces,

(Because) thou burnest on seeing some, and thou becomest soothed on seeing others.

## ॥ २३ ॥ झूमर गीत ।

दे छालो सवत मोरी बेँदिया

जब तू अखतर बेँदिया ना देहो

ता पर मारौँ कटरिया

सवत मोरी बेँदिया

NOTE. अखतर is the Persian اختر 'a star'. G. A. G.

*Translation.*

O co-wife give me my *bēdiyā*.

If thou dost not give me the starry *bēdiyā*,

I shall drive a dagger through thy body.

O co-wife give me my *bēdiyā*.

*Jhūmar* songs are sung on the occasion of marriage, in *Gangā pūjā* and on other occasions of joy. Like the *Sohar* they are sung by the women. The *tikulī* is the spot of silver or a piece of glass worn on a woman's forehead.

## ॥ २४ ॥ झूमर गीत ।

सह्याँ मो से रतियाँ दगा कीनो रे

१ राति कहे सह्याँ कुसुमी रङ्गा दीहौँ

धानी रङ्गा दीन्हो रे

सह्याँ मो से इत्यादि

२ राति कहे सइयाँ भुजनी गढ़ा दीहें  
 नाहीं गढ़ा दीन्हो रे  
 सइयाँ मो से इत्यादि

NOTE. *इना* is Persian لُبَّان. *Kusum* is a bright red dye, and *dhānī* a pale pink. G. A. G.

*Translation.*

- My husband played me false during the night.  
 1. Last night my husband said he would dye (my cloth) with  
*kusumī* colour,  
 But he dyed it with *dhānī* colour.  
 My husband played me false, etc.  
 2. Last night my husband said he would make me a pendant for  
 my nose-ring,  
 But he did not make it.  
 My husband played me false during the night.

॥ २५ ॥ झूमर गीत ।

- १ समुभा देखौ राजा रे बोला करे  
 बोला करे ना बतोला करे  
 समुभा देखो इत्यादि  
 २ सोने के थरिया मैं जेवना परोखें  
 जेवना न जेवे बतोला करे  
 समुभा दे इत्यादि  
 ३ भभर गडुका गङ्गा जल पानी  
 पनिया न पीवे बतोला करे  
 समुभा दे इत्यादि  
 ४ चुन चुन कलियाँ मैं सेज बिकाखें  
 सेजिया न सेवे बतोला करे  
 समुभा दे इत्यादि  
 ५ लौंगा खिलि खिलि बिरवा लगाखें  
 बिरवा न कूँचे बतोला करे  
 समुभा दे इत्यादि

*Translation.*

- Admonish him, oh king, that he converse with me :  
 1. Yes, converse with me and not chaff with me.  
 Admonish him, etc.

2. I give him food on a golden dish,  
(But) he does not eat, he only chaffs with me.  
Admonish him, etc.
3. I give him Gangá water in goblets and jars to drink,  
(But) he does not drink, he only chaffs with me.  
Admonish him, etc.
4. Selecting the finest blossoms I prepare a bed for him,  
(But) he does not lie down, he only chaffs with me.  
Admonish him, etc.
5. Selecting the finest cloves I prepare betel for him,  
(But) he does not chew them, he only chaffs with me.  
Admonish him, oh king, that he converse with me.

## ॥ २६ ॥ बिरहा गीत ।

ताल में जे चमकेला ताल के मङ्ग्रिया  
रन में जे चमके तरुवार  
दस पाँच बीच में सह्याँ के पगड़िया  
सेज पर टिकुली हमार

*Translation.*

As the fishes shine in the tank ;  
As the sword shines in the battle-field ;  
So does the turban of my husband in the midst of many men ;  
So does my *ṭikuli* shine on the bed.\*

The Biraha songs are peculiar to the Ahírs (milkmen) of this part of the country.

## ॥ २७ ॥ लावनी गीत ।

हम पक्षी परदेस मो साफिर फिरते सैलानी  
रहे तुम्हारी नगरी जब लग था दाना पानी  
नगर तुम्हारे रहे मुसाफिर चले स्रोतन अपने  
बोला चाली माफ करो अब भेंट नही सपने  
उड़त गगन में धूर सिपाही जरा तू सुन जा रे  
घोर जहर का पिछाणा अपने हाथ पिना जा रे

\* [*Ṭikuli*, see note to No. 23. *Das pách*, lit. "ten, five," an indeterminate number.—Ed.]



बंगासे का जादू टोना छूँ छूँ सिखती  
 अइसी मोहनी डाल सनम को जाने ना देती  
 घर छोड़े पर जीन सिपाही लश्कर को जा रे  
 काड़ कमर का कटारी मेरे तन में मार जा रे

NOTE. *सेहानी* is derived from the Arabic *سِيلَان*, 'a walk for recreation'. It usually means 'walking at random'. *खोतन* is the Arabic *خَوْتَن*. *जरा* is the Arabic *جَرَا*. *सनम* is the Arabic *صَنَم*. *काड़* is dialectic for *काढ़*. G. A. G.

*Translation.*

I, bird, am a stranger in a foreign land and travel at random. I remained in thy town as long as I had occasion to get food and water. I was as a traveller in thy town, and now I go to my own home. Excuse me—I will not talk to thee, we cannot meet now even in dreams. (Reply.) The sky is bedimmed with a cloud of dust—oh soldier, do listen to me a little. (Mixing) a potion of dire poison, make me quaff it with thy own hands. If I had learnt the enchantments and witchcrafts of Bengal,\* I would have wrought such a magic that I could stop my lover's departure. Do harness the horse, oh soldier, and go to thy campaign. Draw the dagger from thy belt and drive it through my body.

॥ २८ ॥ पीलू गीत ।

१ रामा ! सगरवा बाँध ना  
 य जी मेरा उतरेला बिदेसिया  
 रामा ! सगरवा बाँधू ना ॥  
 २ सिकिया मै चिरि चिरि बेड़ा रे वंधाच्यौ  
 सौती बिरहिया बेले ना  
 रामा ! सगर वा बाँधू ना

*Translation.*

- 1, O Rám, let me make a bridge over the sea.  
 Lo my foreign beloved is to cross over to me.  
 O Rám, let me make, etc.
- 2, I shall get a boat made by reeds cut out.  
 The other wife of my husband croaks out there shall be no union.  
 O Rám, let me make a bridge, etc.

\* In Saháranpur the wandering snake-charmers and conjurors are known as *Bangálís*. The allusion may be to this name.

## ॥ २९ ॥ खम्माच गीत ।

- १ कैसे आऊँ तोरे पास री  
पायल मोरी रनुभुन बाजे  
कैसे आऊँ इत्यादि
- २ चटक चाँदनी रैन कदरपिया  
सास ननद की लाज री  
कैसे आऊँ इत्यादि

*Translation.*

- 1, How shall I come over to thee,  
My anklets make a tinkling sound.  
How shall I come, etc. ?
- 2, The moonshine illuminates the night, oh Kadarpiyá ;  
I am ashamed of my mother-in-law and sister-in-law.  
How shall I come, etc. ?

## ॥ ३० ॥ काफी गीत ।

सह्याँ नहीँ आएँ मैं क्या रे करूँ  
आवन कहि गए अजऊँ न आए  
की बिख खाय मरूँ  
सह्याँ नहीँ आएँ इत्यादि

*Translation.*

My husband has not come, what shall I do now ?  
He went away with a promise to come, but up to this day he has not  
come.  
Shall I take poison and die ?  
My husband has not come, etc.

## ॥ ३१ ॥ काफी गीत ।

सह्याँ निरमोहिया मनाएँ नहिँ माने रे  
कब की मैं ठाड़ि ठाड़ि अरज करतु है  
छतनी अरज मोरी मान  
सह्याँ निरमोहिया इत्यादि

*Translation.*

My husband is cruel, he does not listen to my entreaties ;  
 From a long time I am standing and begging him.  
 Listen to these many entreaties of mine !  
 My husband is cruel, &c.

## ॥ ३२ ॥ भरथरी गीत ।

जोगी हेा के सइयाँ रम चले मैँ जोगिन तेरे साथ ॥  
 साथ चले तिरिया न बने रहना\* बिकट उजाड़ ।  
 चलना पड़े दिन रैन का बारे दूनी उजाड़ ।  
 जाय बसे केही नगरी मैँ धूनी दिँगे जलाय ।  
 ओही नगरी का राजा आवे जोगी के पास ।  
 देखेगा सूरत तेरी रङ्गमङ्गी मन मैँ लावेगा पाप ।  
 तुम को बनावे पाटरानी हमें डालेगा मार ।  
 तो दोबिधा मैँ दोनों गए माया मिले न राम ।  
 पूजा करो दीनानाथ की कि मोहि लगावे बेड़ा पार ।  
 पुत्र कह भिच्छा ढाल दे जोग अमर हो जाय ।  
 समझो क्यों न रानी श्यामदेव ॥  
 बाली रानी ते दिन श्यामदेव सुन राजा मेरी बात ।  
 जोगी हेा के सइयाँ रम जाओगे चौसर खेले मेरे साथ ॥  
 चौसर खेले रानी क्या करे बाजी क्या ल्यों मैँ हाथ ॥  
 हारेँ तो तेरे सङ्ग चलेँ जीतेँ जाने न देँ ॥  
 ऐसी बाजी रानी ना बदे ताक जिये दोनो दाव ।  
 जो बाजी जीते श्यामदेव दस दिन रहेँ बारे मैँ ।  
 जो बाजी जीते भरथरी तुम्हे लेगा गा साथ ॥  
 चौसर जिया मंगाय के खेले राजकुमार ॥  
 पासा जिया रानी हाथ मैँ सुन पासा तू अरदास ।  
 कारम का सङ्ग मेरे दिजिओ पड़ियो सोलह ओ सात ॥

*Translation.*

*Ráni.* Thou art going to wander about, O my husband, as a *Jogí* (hermit). I shall accompany thee as a *Jogini*.

\* [*Na bane rah'nd*, lit. 'dwelling is not made,' idiomatic for 'it is not possible to dwell.'—ED.]

*Rájá.* If a woman go with me, it will be impossible for me to live in the dreary desolate (wilderness); for we shall have to walk on and on, day and night, (and there will be) a double amount of trouble. When we come across a town and take rest, burning incense around us, (who knows,) the king of that town might come to (visit) the Jogí; he will see thy beautiful ruddy face and will entertain evil thoughts. He will kill me and make thee his principal queen. So both will come to grief—earthly joys and heavenly blessings. Worship thou the Protector of the poor (*i. e.*, God), so that He may vouchsafe to me salvation.\* 'Call me thy son, and give me alms, so that my devotions may insure to me immortality (*lit.* be immortal). Oh queen Syámdeo, why dost thou not listen to me?

Thereupon the queen Syámdeo replied: Listen to me, O king; if thou wilt be a hermit and wander about, play with me at dice.

*Rájá.* Why does the Rání want me to play at dice, and what am I to take in my hand as a stake?

*Rání.* If I lose I shall go along with thee, and if I gain I shall not let thee go.

*Rájá.* O queen, pray do not lay such a wager that secures both ends for thyself. (Let it be thus :) If Syámdeo win, I shall stay at home for ten days more, but if Bhar'tharí win, he will not take thee along with him.

Now the prince ordered the dice to be brought, and began to play.

The queen held the dice in her hands and said, "O dice, hear my entreaties; give me the reward of my (good) actions and let there be a cast of 16 and 7."

This little song describes in a few words the legend of Bhar'tharí, king of Nain'ghar, a place said to have been situate somewhere near Mirzapur.† The king suddenly became of an ascetic turn of mind, and was on the point of going to the woods, when the queen interposed with a view to dissuade him. But all these importunities were of no avail. The Rájá did leave his home for the woods, where he became a disciple of Gorakh'náth Báábá. This accounts for the songs relating to the life of Rájá Bhar'tharí being so widely sung by the mendicants belonging to the order of Gorakh'náth Báábá. They sing these songs with a very pathetic and rueful countenance in accompaniment with the harp (*sárang*).

\* [*Lit.*, 'so that he may ferry me across (the sea of life) in a boat.'—*Ed.*]

† [This legend evidently refers to the famous Bhartṛihari, said to be a brother of Vikramáditya of Ujjain, who became an ascetic.—*Ed.*]

## ॥ ३३ ॥ भजन भैरवी की ।

सनमुख राम चरन गहि लीने ।

आवत केवट देखो है दूर ते, धन बिध भाग आज मोहि दीने ॥

चढ़ने न दीहैं नाव पग धोय बिनु, डरत न जी में महुा प्रण कीने ।

धन धन भाग निखाद सुरसरि तट, मारत रहो है जन्म जुग मीने ।

गावें गूदर प्रभु की मरजाद है, तारो ताहि जाहि मत-हीने ।

### *Translation.*

The boatman took hold of the feet of Rám (who was standing) before him,—he had seen him coming from afar,—(and said) “the blessed Lord has given me good luck to-day ; undismayed in my heart I have made a great vow that I will not let Thee get on my boat without washing Thy feet.” Gudur (the author) exclaims, “Oh twice blessed is the luck of the Nishád on the banks of the Sur’sari who has spent his whole life in killing the fish. Oh Lord ! thou art great, save me as thou hast saved the outcast fisherman.”

The following history is connected with this song :—

Ahalyá was the wife of the venerable sage Gautam. Attracted by her beauty, Ind’r the god of the heavens and the disciple of Gautam, impersonated the form of his preceptor and ravished her in his absence. It was at last discovered and Gautam in his rage cursed both, and doomed Ahalyá to turn into a stone, till she was restored to life by the touch of the sacred feet of Rám. The redemption of Ahalyá is thus narrated in the Rámáyan: Rám and Lakshman were going to Janak in the company of the sage Viśwámít’r, and in the way, advised by the sage, Rám placed his feet on the stone, and Ahalyá was immediately restored to life. This news spread all over the vicinity, and hence when Rám wanted to cross the river Sur’sari, the fisherman was afraid lest his boat should turn into a human being, and he be thus deprived of his livelihood.

## ॥ ३४ ॥ गीत ईमनी ।

तुम बिनु नाथ सुने कौन मेरी

जब चाहे तब पार लगाओ

भाभर नाव बिना गुन केरी

ग्राह ग्रसत गजराज उबारोउ

घाफ़ुड नाथ न लाफ़ुड देरी

झूली सती को चीर बड़ाफ़ुड

आरत बचन सुनत दया कर

छरदास प्रसु पतितन वारेउ  
हमरो बार नाथ कैसी देरी

*Note.* This song is, in Bihār, attributed to Tul'sī Dās, and not Sūr Dās. The Bihār version is

तुम बिनु नाथ सुने कवन मेरी  
गहिरी नदिया नाव पुरानी, खेवना नाव बिना गुन केरी  
घाव गहत गजराज उबरैउ, भायैउ नाथ न लायैउ देरी  
भरल सभा में लज्जा राखैउ, खींचत चीर दुसासन केरी  
तुलसी दास आस चरनन के, हमरि बेरि लगायैउ अति देरी. G. A. G.

*Translation.*

Who will listen to me but Thou, O God.

If Thou wilt, Thou canst easily take across (*the sea of life*)

My leaky boat without tackle.

Thou didst save the life of the elephant\* who was seized by the crocodile.\*

Thou hastenedst (to do so), oh Lord, nor didst make any delay.

Thou didst multiply the clothes of the chaste Draupadī,†

\* There is a mythological legend connected with the elephant and the crocodile. They were said to be brothers in a former life in the heavens. Both of them were heroes, and when they fell out with each other, they were cursed to assume their present form. It is said that one day when the elephant went to bathe in the river, the crocodile, not forgetting the former feud, seized the elephant by the leg in the river. When the elephant found that all efforts to extricate himself from the grasp of the crocodile were vain, he implored the mercy of Nārāyan and he forthwith saved him.

† Draupadī was the joint wife of the five Pāṇḍavs, the heroes of the famous epic, the Mahābhārat. The Kurus, the cousins of the Pāṇḍavs, bore enmity with the latter on account of their both aspiring to the throne of Hastināpur, now called Delhi, which legally descended to the Pāṇḍavs. Śakuni, the maternal uncle of the Kurus, was a very successful player at dice, and confiding in his success Durjodhan, the head of the Kurus, invited Yudhishtīr, the head of the Pāṇḍavs, to a play at dice, an offer which the latter could never refuse. Śakuni, on behalf of Durjodhan began to play with Yudhishtīr, and the latter lost all the games till he had lost his whole kingdom and even the freedom of his own person and his brothers. At last he was compelled to lay his wife Draupadī as a stake for the next game, and he lost her also. Duḥśāsana, the wicked brother of Durjodhan, dragged Draupadī into the assembly and put her to disgrace. At last Durjodhan ordered Duḥśāsana to strip her of her clothes. This was actually attempted, when she cried aloud imploring the help of her god, by whose grace she was supplied with fresh clothes as soon as the one on her person was snatched away, till a large heap of clothes was gathered in the assembly. The Kurus, finding their successive attempts to disgrace her baffled, left her alone. This event is said to have been one of the causes of the great war of the Mahābhārat.

(No sooner) thou heard'st the cry of the woman's distress.  
 Súr'dás (exclaims), "O Lord, thou hast saved many a sinner,  
 Why then dost thou delay in saving me (*lit.* how much delay is  
 there in my time or case ?" G. A. G.)

## ॥ ३५ ॥ भजन काफी ।

हमारे प्रभु अछगुन चित न धरो  
 समदरसी तू नाम तेहारो ।  
 चाहो तो पार करो ॥  
 एक नदिया एक नार कहावत ।  
 मैला नीर भरो ॥  
 जब मिलिहे तब एक बर्य होय ।  
 सुरसर नाम पड़ो ॥  
 एक लोहा पूजा में राखत ।  
 एक घर बधिक करो ॥  
 सो देविधा पारस नहि राखत ।  
 कछन करत खरो ॥  
 माया ब्रह्म एक कहलावत ।  
 दूर स्याम भगरो ॥  
 कि मेरो निसतार करो ।  
 प्रभु नहिँ पन जात टरो ॥

### *Translation.*

Do not, O Lord, take my sins into consideration ;  
 For thou art called the impartial.  
 Thou canst save at thy will.  
 One is called a river, the other (is called) a drain  
 And is full of dirty water ; but when they join, they become of one  
 colour,  
 And the name of Sur'sar (Ganges) they bear.  
 One piece of iron is used in worship,  
 Whereas another piece is used as a weapon of destruction ;  
 But the philosopher's stone (Paras) makes no distinction between  
 the two,  
 It turns both into pure gold.

Máyá and Brahm are called the same,  
 (But) Súr and Syám (needlessly) dispute about it.  
 That thou wilt save me,  
 —oh Lord, do not fail (to fulfil) that promise.

## ॥ ३६ ॥ सोहनी ।

जाय के जसोदा से कहोंगी रे  
 सूधे रहो न कुसो कर सों कर ।  
 बरजत भई अब नाहि सङ्गगी रे ॥  
 जो तुम हार को हाथ चलाओ, तो ।  
 लाल मैझ बनमाल गङ्गगी रे ॥  
 बरजो रहि, बरजो नहि मानत ।  
 गाली दिय बिन नाही रहोंगी रे ॥  
 जाय के जसोदा इत्यादि

### Translation.

I will go and report it to Jasodá ;  
 Be good and don't touch my hand with yours ;  
 Enough has been done, I will not endure any more.  
 If you put your hand on my *hár* (golden garland),  
 O beloved, I too shall take hold of your *ban'mál* (flower garland).  
 I am prohibiting him, but he will not heed my prohibition.  
 I shall not cease abusing you.  
 I will go to Jasodá, etc.

## ॥ ३७ ॥ सोहनी ।

काँध दे गयो गारी गोइयाँ कवने नाते ?  
 ले कर चीर कदम चढ़ि बैठे  
 हम जल माँह उधारी  
 काँध दे गयो इत्यादि

### Translation.

O friend, Kándh has gone away chaffing me (I do not know) by  
 what (right of) relationship ;\*  
 He has taken away my clothes and climbed on the kadam tree ;

\* [This appears to allude to the custom, that only certain relations are allowed to chaff ; thus, a younger brother can laugh with, and chaff, his elder brother's wife.—Ed.]



I am naked in the water.  
Kándh has gone away, etc.

## ॥ ३८ ॥ परच ।

अँखिया फरकन लागी रे मेरी  
क्या ऊर यार ? किधर गई सखियाँ ?  
अँखियाँ इत्यादि  
देह फुकतु है जिया तड़पतु है  
प्रीत लागार मजा उन चखियाँ  
अँखियाँ इत्यादि  
नेनन में दिलदार बसतु है  
इन अँखिया अलमस्त परखियाँ  
अँखियाँ इत्यादि  
बलि बलि जाऊँ मैं ओसताद के,  
बीच सभा में मेरी पति रखियाँ  
अँखियाँ इत्यादि

### *Translation.*

My eyelids are trembling.  
What has become of my love, where have my friends gone ?  
My eyelids, etc.  
My body is inflamed and my heart is beating ;  
He has made love to me and taken his fill.\*  
My eyelids, etc.  
My lover lives constantly in my eyes.  
These eyes of mine are sure tests of my love.  
My eyelids, etc.  
I entirely resign myself to God,†  
May he preserve my honour in the assembly. ‡

\* [Majá is the Persian mazá مزاج, which is properly masc., though it is here repeated as fem. ; the phrase literally means : he has sipped the taste ; it is idiomatic for 'he has satisfied himself.'—Ed.]

† [Lit. 'I become a sacrifice to my teacher.'—Ed.]

‡ [I. e., among the people. The line alludes to the story of Draupadī ; see footnote on p. 251.—Ed.]

## ॥ ३९ ॥ परच ।

- १ पज्जं चा दे हम को कोइ उन तक ।  
 निकस जात मोरे जिया की कसक ॥  
 उच्चै चाटाड़ी चड़ि देख घटा ।  
 बिजुली रहि जात चमक चमक ॥  
 तन थरथरात पग डगमगात ।  
 सखी जियरा होत मोरा धकधक ॥  
 पज्जं चा दे इत्यादि
- २ सधर काँधार्दे निठुराई चतुराई ।  
 मोहि जान पड़ी तोरी तनिक तनिक ॥  
 काऊ सङ्ग निस दिन चैन करत ।  
 काऊ तरसाए देखला के भलक ॥  
 पज्जं चा दे इत्यादि

*Translation.*

- 1, Let somebody take me to him ; the desire (*lit.* the pain) of my heart will then be satisfied.  
 Getting upon the roof of a high house I see the cloud ; the lightning again and again shines and disappears.  
 My body is shaking and my feet trembling ; my heart, O friend, is beating high.  
 Let somebody take me to him, etc.
- 2, O fine Kándhā, I have known only a little of thy cunning and cruelty, With some thou passest day and night, while thou tantalisest others by only exhibiting thy brilliance.  
 Let somebody take me to him, etc.

## ॥ ४० ॥ होली गीत ।

- कवन जात बज मे दधि बेचन  
 रङ्ग डारी चूनर सारी रे  
 एक हाथे काँधा मेरो अँचरा जो पकड़े  
 दूजे हाथ मेरे सारी रे  
 आन पड़ी बस तेरे रे मोहन  
 नित उठि दीने गाली रे

*Translation.*

Who will go to Brij to sell curds,  
(Seeing that) He (Krish'n) will sprinkle coloured water over one's  
*chúnar* and *sári*?

For (on a previous occasion) Kándhá (Krish'n) caught hold of the  
skirts of my cloth with one hand,

And with the other my *sári*;

Then I said, O Mohan, I have fallen into thy power;

But every morning since then I curse him.

## ॥ ४१ ॥ होली ।

- १ पिचुकारी से मुरारी रङ्ग डारी रे  
भर पिचुकारी मेरे मुख पर मारी  
भोज गई तन सारी रे  
२ भीज गइ मेरो घेर घाघरा  
सारी लाख हजारि रे  
पिचुकारी से इत्यादि .

*Translation.*

- 1, The Murári (Krish'n) has sprinkled coloured water with his syringe,  
A whole syringe full he has thrown on my face.  
My entire body has become wet.
- 2, My entire gown (*ghágrá*) has also become wet,  
And my *sári* (wearing cloth) worth a thousand lacs.  
With a syringe, etc.

## ॥ ४२ ॥ खम्माच ठुमरी ।

आओ बालम राज, कैसी करू नही पड़न चैन  
आओ बालम राज  
तलफ तलफ दिन बितत मै का  
चाँद पिया बिन नोद न आवेक  
चिड़क उठी जिय मति तरसा  
आओ बालम राज

*Translation.*

Come, O Bálam Ráj, whatever I may do, I cannot get peace;  
Come, O Bálam Ráj.  
My days pass in anguish,  
And at night without my beloved no sleep comes to me.  
My heart starts in pain; do not tantalise me.  
Come O Bálam Ráj.

## ॥ ४३ ॥ खम्माच ठुमरी ।

प्रीतम प्रीत लगार्ई सुरत मोरी काहँ बिसराई राम  
 तुमारे इक्का में प्यारे उठाया हम ने गम सारी  
 फिरोँ मैं बन बन मन मारे मौला बिरह से कर न्यारे  
 प्रीतम प्रात इत्यादि

*Translation.*

O beloved, having made love to me, why hast thou forgotten (to pay) attention to me.  
 In my love of thee, O beloved, I have endured all (manner of) pains ;  
 Broken-hearted I wander about in the forests ; O God, relieve me  
 from (this pain of) separation.  
 O beloved, etc.

## ॥ ४४ ॥ खेमटा काफी में ।

केत समुभाव जिच्या मानत नाही  
 मानंत नाही जिच्या मानत नाही  
 नई नई प्रीत सुलतान पिया की  
 बालो भोली कुक् जानत ना ही

*Translation.*

However long you may remonstrate (with me), my mind will not listen,  
 Oh, it will not listen, my mind will not listen.  
 My love to my beloved lord (*lit.* Sultán) is ever coming anew,  
 But being a simple-minded girl, I know nothing (of what will be the consequence).

## ॥ ४५ ॥ खेमटा काफी में ।

साँवली सूरत मो से भूलत नाही  
 भूलत नाही जिया डोलत नाही  
 हटो सखी मोहि जिन समुभाओ  
 लागि लगन अब कूटत नाही

*Translation.*

I cannot forget the beautiful face (of my love) ;  
 Oh I cannot forget, it cannot be removed from my mind.  
 Away, friend, do not remonstrate with me ;  
 The attachment once formed cannot be broken asunder.

## ॥ ४६ ॥ पीलू ठुमरी ।

मैं तो अलबेलो रे  
 हमारा कोई क्या करे  
 अपने सह्याँ की मैं बड़ी रे दुलारो रे  
 घर में हमी अकेली  
 हमारा कोई क्या करे

*Translation.*

I am young and lovely ; what (more) can any one do (for me) ?  
 I am the greatly beloved of my husband ;  
 I am his single wife in the house.  
 What (more) can any one do (for me) ?

## ॥ ४७ ॥ पीलू ठुमरी ।

कैला गाली न दे रे सुनेँगे सब लोगवा  
 आर पास के लोगवा सुनेँगे रे  
 सास सुनेगी जियरा मारी रे  
 सुनेँगे सब लोगवा

*Translation.*

Boy, don't joke with me, all people will hear ;  
 Yes, all my neighbours will hear.  
 If my mother-in-law hears, she will kill me.  
 All people will hear.

## ॥ ४८ ॥ दोहरा ।

बेसुया, बारन, अगिन, जल, कूटी, कटक, कलाल ।  
 — ई दसो नहि आपना — स्रगा, स्रई, सोनार ॥

*Translation.*

Prostitute, monkey, fire, water, hermit, weapon and wine-merchant  
 as well as parrot, needle and goldsmith—these ten are never one's friend.

## ॥ ४९ ॥ दोहरा ।

चम्पा तुम में तीन गुण रङ्ग रूप और बास  
 रेगुना तुम में एक है कि भौर न बैठत पास

(उत्तर) भौरा रसिया फूल का कबी कबी रस  
हरजाई के मित्र को पास न बैठन दे . .

*Translation.*

O Champá (flower) thou hast three properties in thee :  
Colour, beauty and fragrance,  
(But) thou hast one defect, that the black-bee does not  
come near thee.

*Reply.* The black-bee is the lover of flowers and it tastes the  
sweets of numerous flowers.  
I do not allow the friend of prostitutes to come near me.

*Notes from Varāha Mihira's Pañchasiddhāntikā.—*

*By G. THIBAUT, PHIL. DR.*

## PART I.

### THE MEAN MOTIONS OF THE PLANETS ACCORDING TO THE SŪRYA AND ROMAKA SIDDHĀNTAS.

We are at present fairly well-acquainted with the general character of Hindú Astronomy and—among European scholars at least—there prevails no longer any doubt that the system exhibited in works like the *Sūrya Siddhānta*, the *Laghu-Āryabhaṭīya*, etc. is an adaptation of Greek science. The time to which books like the *Sūrya Siddhānta* must be ascribed from internal data, the date of *Āryabhaṭa*,—if not the oldest, at least one of the oldest of the scientific Hindú Astronomers—which we know from his own statement, the fundamental similarity of the methods employed by the Greeks on the one and the Hindús on the other side, the fact of terms of unquestionably Greek origin being met with in Indian astronomical works, and lastly the testimony which the Hindú writers themselves bear to the proficiency of the Yavanas in the *Jyotiṣha S'āstra* more than suffice to convince impartial judges that the enormous progress which a book of the class of the *Sūrya Siddhānta* marks on works of the nature of the *Jyotiṣha Vedānga* was not effected without help coming from the West.

But although the general fact of transmission is acknowledged the details of the process still stand in need of much elucidation, and we shall not be able to claim a full understanding of the position of the

Hindú system before we have succeeded in tracing the single steps of the gradual transformation by which it arose from its Greek prototype, and in assigning the reasons of the many important points of divergence of the two. Whether this task will ever be accomplished completely is doubtful. The chief obstacles in the way of success are the loss of several of the most important early Siddhāntas which, as their names indicate, were specially connected with Western science, and the uncertainty whether the form in which the preserved Siddhāntas have come down to us is the original one or has, in the course of time, undergone alterations. All we can do is to study with the greatest possible care those astronomical books which may to a certain extent make up for the mentioned loss, and enable us to gain some insight into the genesis and original condition of what we may call—in order to distinguish it from earlier and greatly inferior attempts—Scientific Hindú Astronomy.

Among the works belonging to that class by far the most important is the so-called *Pañchasiddhāntikā* by *Varāha Mihira*. References to this treatise which—as its name implies—is founded on five Siddhāntas, were occasionally made by European scholars from the first time when Hindú Astronomy began to attract attention. Manuscripts of the work itself indeed were not forthcoming for a long time, and the important quotations made from it by *Colebrooke* and subsequent writers, among whom *Professor Kern* is to be mentioned in the first place, were taken from later astronomical books, chiefly from the Commentary on *Varāha Mihira's Brihat-Samhitā* by *Bhaṭṭotpala* who in many places endeavours to render his explanations of the latter work more lucid by extracting corresponding passages from the *Pañchasiddhāntikā*. These quotations were, however, amply sufficient to show the extraordinary importance which the treatise in question possesses for the history of Indian astronomy, and it was therefore most welcome news to all students of Sanskrit when *Dr. Bühler*, whose sagacity and activity in tracing and rescuing from destruction really valuable Sanskrit books stand in no need of further praise, was able to announce in 1874 the discovery of a complete manuscript of the *Pañchasiddhāntikā*. A second somewhat more correct manuscript of the work was later on discovered by the same scholar. Both manuscripts were purchased for the Bombay Government.

Nothing could now be more desirable than an early edition and translation of the entire *Pañchasiddhāntikā*; but unfortunately there are considerable obstacles in the way of a speedy realization of such a wish. In the first place, the two available manuscripts are exceedingly, in more than one case, hopelessly incorrect. In the second place, the text, even if presented in a correct and trustworthy shape, offers to the interpreter unusually great difficulties whose special nature will be set

into a clearer light by a short consideration of the class of books to which the *Pañchasiddhāntikā* belongs.

The *Pañchasiddhāntikā* is a so-called *karana*grantha. The only definition of the term “*karana*” by a European scholar of which I know\* is the one given by Professor Kern, who says (preface to the *Bṛihat Saṃhitā*, p. 24) that a *karana* differs from a *Siddhānta* in this respect, that while in the latter the calculations refer to the beginning of the Yuga, in the former they refer to the *Saka* era. This statement is quite correct, but not full enough to give an adequate idea of the nature of a *karana*. A *karana* may be defined as a practical treatise on astronomy, i. e., a treatise which enables the astronomer to execute the common astronomical calculations known to the Hindūs with the greatest possible ease and despatch. While a *Siddhānta* explains the general principles of the Hindū astronomical system, and thereby enables the attentive student to construct for himself the rules which are to guide his calculations, a *karana*grantha exhibits those rules ready made and reduced to the most practical and succinct shape without, however, explaining the theory on which they are based. A *karana*grantha is thus sufficient for all practical purposes, but not really intelligible without the study of the *Siddhānta* from which its rules are derived. That it takes for the starting-point of its calculations not the beginning of the Yuga or kalpa but that of the *Saka* era is of course merely a consequence of the desire to render all calculations as easy and short as possible. The most important books of the *karana* class are the *Grahalāghava* by Gaṇeśa Daivajña, the *Bhāsvatī* by Śaṭānanda, the *Karṇakutūhala* by Bhāskara and, among more ancient works, the *Khaṇḍakhādyaka* by Brahmagupta and, holding the first rank in importance, the *Pañchasiddhāntikā*.

This latter work has, however, a wider scope than an ordinary *karana*grantha. It does not form the practical complement of one *Siddhānta* only, as for instance the *karṇakutūhala* does with regard to the *Siddhānta* *Śiromaṇi*, but as its name indicates, it gives rules in accordance with five different *Siddhāntas*. These *Siddhāntas* are, as we now may see from the introductory verses of the *Pañchasiddhāntikā* itself, while formerly our information regarding them was derived from the *Bṛihat Saṃhitā* and its commentary, the *Saura*, *Paulīṣa*, *Romaka*, *Vāsishṭha* and *Brāhma* or *Paitāmaha* *Siddhāntas*. Of these five *Siddhāntas* only the *Saura* or *Sūrya* *Siddhānta* is known to exist at present. The *Paulīṣa*, *Romaka*, *Paitāmaha* *Siddhāntas* appear to be lost; I am doubtful whether the *Vāsishṭha* *Siddhānta* to which *Varāha Mihira* refers has come down to our time or not. We are thus on the whole not in a position to elucidate the highly condensed and often altogether enigmatical rules of the *Pañchasiddhāntikā* by referring to the *Siddhāntas* on



which they are founded, but must explain them by themselves as well as we can, availing ourselves of the fragmentary collateral information which may be derived from other sources, and must finally attempt to reconstrue from the *karāṇa* rules the leading features of the *Siddhāntas* on which they were founded. The latter part of the task is of course the most important, but at the same time the most difficult one, and we shall for the present succeed in it only very partially. Were it not that *Varāha Mihira* has allowed himself in many points to be more circumstantial than ordinary *karāṇa*-writers are, so that the *Pañchasiddhāntikā* may in fact be said to occupy a kind of intermediate position between a *karāṇa* and a *Siddhānta*, the task would be an altogether hopeless one. As it is, it remains difficult enough and only the manifest importance of the book can maintain the zeal of the student whose efforts at unravelling the sense of the obscure stanzas are foiled more than once. There are of course a considerable number of passages which are by no means difficult to understand, some entire chapters even fall under that category; but then those chapters and passages are easy because they contain no matter new to us and merely restate what we already know from other sources. The chapters which add to our store of knowledge are throughout difficult, some of them so much so that there is no chance of their being fully understood until better manuscripts of the *Pañchasiddhāntikā* are found. Other passages again, although difficult, may be explained satisfactorily. Some of this latter class, *viz.*, those treating of the mean motions of the planets according to two *Siddhāntas* will form the subject of this paper.\* A few introductory remarks on the contents of the entire work and the consideration of a few specially interesting passages will be premised before we enter on our special task.

The *Pañchasiddhāntikā* appears to be divided into eighteen *adhyāyas*, although the exact number may be a matter of some doubt, as in the manuscripts the endings of the chapters are not very clearly marked, and

\* I may mention here that I am engaged, with the assistance of Pandit *Sudhākara* one of the foremost *Jyotishis* of Benares, in preparing an edition and translation of the entire *Pañchasiddhāntikā* as far as the deficiencies of the manuscripts etc. will allow. But as it is uncertain when this task will be accomplished, I think it advisable to publish in the interim some of the more interesting results. I avail myself of this opportunity to acknowledge the very valuable assistance I have received from Pandit *Sudhākara* in preparing the present paper. He has verified many of my calculations and in some points tendered original suggestions which were most useful. I specially mention his advice to calculate the *kshepa* quantities of the *Sūrya Siddhānta* from the beginning of the *Kalpa*, an advice the carrying out of which led to most satisfactory results.

the numbering of the stanzas is carried on through several *adhyāyas*. The first *adhyāya*, called *karaṇāvatāra*, contains some introductory verses, a rule for the calculation of the *ahargana*, statements regarding the different *yugas* used in the *Paulīśa*, *Romaka*, *Sūrya Siddhāntas*, and some rules regarding the calculation of the regents of the years, months, etc. The second very short *adhyāya* is called at its end *nakṣatrādichheda* and apparently contains rules about the mean places of the moon, length of day and night, shadow, etc. The third *adhyāya* is marked at the end "Paulīśa Siddhānta" and contains the most important rules for the calculation of the mean place of the sun, the true places of sun and moon, the moon's node, latitude, terrestrial longitude, *ayana*, etc. The fourth *adhyāya*, marked merely as "*karaṇādhyāyaś caturthaḥ*" contains the table of sines and matter corresponding to that of the third *adhyāya* of the *Sūrya Siddhānta*. The very short fifth *adhyāya* is entitled *Saśidarśanam*. The sixth *adhyāya* contains *chandragrahaṇam*, i. e., the rules for calculating lunar eclipses according to the *Paulīśa Siddhānta*, the matter of all the preceding chapters having been merely preliminary to the calculation of eclipses. The seventh *adhyāya* treats of solar eclipses "*Paulīśa siddhānte ravigrahaṇam*." The eighth chapter treats of the calculation of solar eclipses according to the *Romaka Siddhānta* and contains at the same time all the general information about the *Romaka Siddhānta* which the *Pañchasiddhāntikā* affords. The ninth *adhyāya* has for its subject the calculation of solar eclipses according to the *Sūrya Siddhānta* with preliminary statements about the mean motions, etc. of sun and moon. The tenth *adhyāya* treats of lunar eclipses according to the same *Siddhānta*. The eleventh *adhyāya* called at its close "*avarṇanātyekādaśo 'dhyāyaḥ*" contains additional matter about eclipses. The twelfth very short *adhyāya* "*paitāmahasiddhānte dvādaśo 'dhyāyaḥ*" is the only chapter which treats of the *Paitāmaha* or *Brāhma Siddhānta*. The thirteenth *adhyāya* "*trailokyasaṁsthānam*" contains information akin to that which is found in the twelfth chapter of the *Sūrya Siddhānta*. The fourteenth *adhyāya* "*chhedyakapaṇṭrāṇi*" gives information about astronomical instruments, etc. The fifteenth *adhyāya* "*jyotiṣopaniṣad*" states the differences produced in eclipses of the sun by difference of locality; the different opinions about the beginning of the day, etc. The sixteenth *adhyāya* "*sūryasiddhānte madhyagatiḥ*" states the mean motions of the planets according to the *Sūrya Siddhānta*. The seventeenth *adhyāya* "*tārāgrahasphuṭikaraṇam*" gives the rules for calculating the true places of the planets. The last *adhyāya* "*Paulīśasiddhānte tārāgrahāḥ*" contains rules about the heliacal rising and sitting etc. of the planets, apparently according to the *Paulīśa Siddhānta*.

The introductory verses in which Varāha Mihira states the purport of the entire *Pañchasiddhāntikā* run as follows :—

दिनकरवसिष्ठपूर्वान् विविधमुनीन्द्रान् प्रणम्य भक्त्यादौ ।  
जनकं गुरुं च शस्त्रे येनास्मिन्नः कृतो बोधः ॥  
पूर्वाचार्यमतेभ्यो यच्छ्रेष्ठलघुसूटं बीजम् ।  
तत्तदिहविकलमहं\* रक्षस्यमभ्युद्यतो वक्तुम् ॥  
पौलिशरोमकवासिष्ठसौरपैतामहास्तु पञ्च सिद्धान्ताः ।  
पञ्चभ्यो द्वावाद्यौ व्याख्यातो लाटदेवेन ॥  
पौलिशतिथिः† सूटोऽसौ तस्यासन्नस्तु रोमकप्रीतः‡ ।  
स्यष्टतरः सावित्रः परिशेषो दूरविधटौ ॥  
यत्तत्परं रक्षसं धमति मतिर्यच्च तन्त्रकाराणाम् ।  
तदहमपचाय मत्सुरमस्मिन्मध्ये ग्रहं भानोः ॥  
दिक्स्थितिर्विभर्दकर्णप्रमाणवेला ग्रहाग्रहाविन्दोः ।  
ताराग्रहसंयोगं देशान्तरसाधनं§ चास्मिन् ॥  
सममण्डलचन्द्रोदययन्त्रच्छेद्यानि शाङ्कवच्छाया॥ ।  
उपकरणाद्यक्षयावलम्बकापक्रमाद्यानि ॥

These verses are followed by the rule concerning the calculation of the *ahargana* which will be considered later on. In the last chapter the author names himself as Varāha Mihira of Avanti.

I further extract a statement found in the 3rd chapter which is of considerable interest as containing a very clear indication of the dependence of Hindú astronomy on Greek science. We read there :

यवनान्तरजा नाड्यः सप्तवन्त्यां¶ विभागसंयुक्ताः ।  
वारणस्यां चिह्नतिः साधनमन्यच्च वक्ष्यामि ॥

"The nádis arising from the difference in longitude from Yavana, (i. e., Yavanapura) are seven and a third in Avanti, nine in Benares; the method of ascertaining them I will state elsewhere."

The verse contains a statement of the difference in longitude between Ujjain and Benares on the one side and Yavanapura on the other side. That by the latter name (which occurs in another place of the *Pañchasiddhāntikā* also) we have to understand Alexandria has been remarked by Professor Kern already; the passage we are considering at present

\* A. तत्तदिहविकलम० B. तत्तदिहविकलम०

† A. •तिथिसूटु० B. •तिथिः सूटु०

‡ A. •मकः

§ A. •सावनं

॥ P A. •प्रेप्रानिता (ह added in margin) वक्ष्याया B. वक्ष्यानिताखवक्ष्याया.

¶ Both MSS. •वन्त्याविभा०

furnishes the proof. The real eastern longitude (from Greenwich) of Ujjain is  $75^{\circ} 51' 45''$ , that of Benares  $83^{\circ} 3' 4''$ , that of Alexandria  $29^{\circ} 52'$ ; therefore, the seconds being neglected, Ujjain is in  $46^{\circ}$  E. Long. Benares in  $53^{\circ} 11'$  E. Long. from Alexandria. If we now, on the other hand, calculate the difference in longitude of the mentioned three places from the difference in time stated by Varāha Mihira we obtain  $44^{\circ}$  as the longitude of Ujjain from Alexandria and  $54^{\circ}$  as the longitude of Benares from the same place. The error involved in Varāha Mihira's determination is not inconsiderable, but not greater than might have been expected, certainly not too great for our assuming with confidence that Yavanapura is to be identified with Alexandria.\* As a transfer of Hellenic astronomy to India could not have taken place without some determination of the interval in longitude we might assume such a determination to have been made even if no trace of it had been preserved in India; still it is satisfactory to find the determination explicitly stated in the book which professes to give an account of the fundamental Siddhāntas.

Before leaving this subject we must refer to another passage of the *Pañchasiddhāntikā* which is quoted by Bhaṭṭotpala, and which has been supposed to contain likewise a statement about the difference in longitude between Ujjain and Alexandria. It occurs in the 15th adhyāya and need not be reprinted here in full as it has already been published by Professor Kern in his paper on some fragments of Āryabhaṭa, *Journal of the Royal Asiatic Society*, Vol. XX, 1863 and again in the Preface to his edition of the *Bṛihat Saṃhitā*, p. 53. The two lines immediately concerning us here are given by Professor Kern, as follows :

रव्युदये लङ्कायां सिंहाचार्येण दिनगणोऽभिहितः ।

यवनानां निशि दशभिर्मुहूर्तैश्च तद्गृहणात् ॥

and rendered "Sinhāchārya states the sum of days (to begin) from sunrise at Laṅkā and, if we adopt this, they must begin in the country of the Yavanas at the time that ten muhūrtas of the night are past." From this Professor Kern concludes that in the opinion of Varāha Mihira the meridian of Yavana-pura has a longitude west from the meridian of

\* Professor Kern notices the possibility of Yavanapura being not Alexandria but Constantinople, but rejects it on the ground of no first meridian ever having been drawn over the latter place. If we identified Yavanapura with Constantinople we should reduce the above-mentioned error of longitude by one degree; but nevertheless its identification with Alexandria is much more likely if we consider firstly the general importance of Alexandria; secondly, its geographical position with regard to India, and thirdly, its having been the place where the system of Greek astronomy was finally elaborated.

Lañkā, of 60 degrees. (See Preface, p. 54.) This translation of the text as given by Bhaṭṭotpala and the inference he draws from it are indeed quite correct; but we see at once that the passage as it stands cannot be reconciled with the one translated above from which there results a difference of longitude amounting to 44° only. The apparent contradiction is solved when we turn to the text of the *Pañchasiddhāntikā* as exhibited in the two manuscripts available at present. For there the reading at the conclusion of the second line is not *तद्ग्रहणात्* but *तद्गुहणा*, so that we have to translate “*Simplicius* states the sum of days to begin from sunrise at Lañkā; when ten muhūrtas of the night of the Yavanas are passed (the day is stated to begin) by their guru, (i. e., the guru of the Yavanas who I suppose is no other than the often-quoted astronomical writer *Yavaneśvara*).” The two lines therefore contain unconnected statements, and do not in any way enable us to draw a conclusion about what *Varāha Mihira* considered to be the relative longitude of Lañkā (or Ujjain) and Alexandria. In addition I quote a passage from some unknown writer found in the *Marichī* (on *Siddhānta-Siromaṇi*, *Gaṇitādhyāya*, *Madhyamādhikāra*, *deśāntara*) which being apparently a periphrase of the passage from the *Pañchasiddhāntikā* confirms the text and translation of the latter as given above :

केचिद् वारं सवितुषदयात् प्राञ्चरन्ते दिनार्धात् ।

भानोरर्धास्तमयसमयाद्गृचिरे केचिदेवम् ॥

वारास्यादिं यवननृपतिर्दिङ्मुकुर्ते निशायां ।

लाटाचार्यः कथयति पुनस्तार्धरात्रे स्वतन्त्रे ॥

“Some declare the day to begin from sunrise, others from noon; again others from the moment when the sun has half set. The prince of the Yavanas reckons the beginning of the day from (the moment when) ten muhūrtas of the night (are past), *Lātāchārya* again in his book from midnight.”

Here, the “*yavanarīpatiḥ*” of the third line answers to the *yavanaguru* of *Varāha Mihira* and renders the identification of the latter with *Yavaneśvara* more probable. The statement made in the last line about *Lātāchārya* is mistaken as, according to the *Pañchasiddhāntikā*, that writer reckoned the beginning of the day from sunset, while midnight was chosen as starting-point by *Aryabhaṭa*.

After these preliminaries we now enter on a discussion of those passages of the *Pañchasiddhāntikā* which contain the rules for the calculation of the mean places of the planets according to the *Sūrya* and *Romaka Siddhāntas*. Beginning with the former we at first extract a stanza of the 1st adhyāya which furnishes us with the requisite informa-

tion about the yuga acknowledged by the *Sūrya Siddhānta* as known to *Varāha Mihira*.

वर्षायुते द्दतिन्ने नववस्तुगुणरसरसाः स्युरभिमासाः ।

सावित्रे शरनवसेन्द्रियार्थवाशाक्षिप्रलयाः ॥

“According to the *Sūrya Siddhānta* there are in 180,000 years 66,389 intercalary months and 1,045,095 omitted lunar days.”

Comparing these statements with those to be found on the same point in the hitherto known *Sūrya Siddhānta*, we observe of course at once that the *Pañchasiddhāntikā*, as was to be expected from a *karapa-grantha*, employs reduced numbers. The known *Sūrya Siddhānta* gives the corresponding figures for a *mahāyuga* of 4,320,000 years of which, period the 180,000 years of the *Pañchasiddhāntikā* are the twenty-fourth part. We therefore multiply the 66,389 intercalary months by 24 and find that the product 1,593,336 agrees with the figure which the *Sūrya Siddhānta* (I. 38) gives for the intercalary months. We, however, meet with a discrepancy when comparing the two statements regarding the number of the omitted lunar days. The *Sūrya Siddhānta* (I. 38) assumes the number of omitted lunar days in one *mahāyuga* to be 25,082,252, while the number stated above, 1,045,095, multiplied by 24 gives as product 25,082,280, which figure exceeds the former one by 28. If we now proceed to deduce from the above statements about the nature of the yuga of the *Sūrya Siddhānta* as known to *Varāha Mihira* the length of the sidereal solar year (by calculating according to the known Indian fashion the number of the tithis of the entire yuga, deducting from it the *tithikshayas* and dividing the remainder by the number of solar years) we obtain as the result  $365^d 6^h 12' 36''$ ; while the length of the year of the known *Sūrya Siddhānta*, in accordance with the smaller number of the omitted lunar days, amounts to a little more, *viz.*,  $365^d 6^h 12' 36.56''$ . The discrepancy is a slight one, but it suffices to show that the *Sūrya Siddhānta* which *Varāha Mihira* had before himself was different from the one known to us. It might perhaps be objected that the discrepancy is only an apparent one, *Varāha Mihira* having slightly changed one of the numbers of the *Sūrya Siddhānta* in order to be able to reduce all numbers more considerably and thereby to establish more convenient rules for calculation. That the *karapa* writers are in the habit of proceeding in that manner is well-known, and we shall see later on that *Varāha Mihira* submits in certain cases the exact numbers to certain alterations. The present case, however, is of a different nature. The passage about the yuga of the *Sūrya Siddhānta* is not an independent rule, in the formulation of which the writer might have allowed himself certain liberties, but a mere statement reproducing

the doctrines of another work, and as such it would be of no value whatever if it were not strictly accurate. We shall moreover meet later on with several other instances showing that the mere fact of Varāha Mihira's statements not agreeing with the known Sūrya Siddhānta is not sufficient to throw a doubt on their accuracy. It is finally to be remarked that the solar year of the Sūrya Siddhānta as known to Varāha Mihira is identical with the solar year of that Paulīśa Siddhānta about which Bhaṭṭotpala in his commentary on the Brihat Saṃhitā has given us some information (*Cf.* Colebrooke's *Essays*, II, p. 365).

We next turn to some verses containing rules for the calculation of the mean places of sun and moon according to the Sūrya Siddhānta. They are found in the 9th adhyāya :

द्युगणे ङ्को ऽष्टमशतन्ने विपक्षवेदार्णवे ङ्कोसिद्धान्ते ।

स्वरखाद्विदिनवयोद्धते क्रमाद् दिनदले ऽन्याम्\* ॥

"The (mean place of the) sun is found, for midday at Avanti, by multiplying the ahargana by 800, deducting 442, and then dividing by 292,207."

This verse contains two elements which are to be considered separately; in the first place a general rule for calculating the mean place of the sun, in the second place a so-called kshepa, *i. e.*, an either additive or subtractive quantity whose introduction into the rule enables us to take for the starting-point of our calculations the epoch of the karaṇa instead of the beginning of the yuga. The general rule is understood without difficulty. It bases on the proportion: if in 65,746,575 sāvāna days (*i. e.*, the sāvāna days contained in 180,000 years), there take place 180,000 revolutions of the sun or, both numbers being reduced by 225, if 800 revolutions take place in 292,207 days, how many revolutions will take place in the given ahargana? The result is the mean place of the sun at the end of the given ahargana. We now turn to the kshepa 442. If on the first Chaitra Śaka 427, which date is the starting-point of all calculations of the Pañchasiddhāntikā,† the sun had performed an entire number of revolutions without remainder a kshepa would of course not be required. The actual kshepa, 442 on the other hand shows that at the mentioned time  $\frac{442}{292207}$  were wanting

\* Both manuscripts read in the first line ङ्को, in the second स्वरखाद्विदिनव०. The second emendation is shown by calculation to be necessary. Both emendations are borne out by the manuscripts of Bhaṭṭotpala who quotes the above verse. A. reads हलेवत्यां B. ०लेवत्यां.

† See about this point the rule for calculating the ahargana which will be discussed later on in connection with the Romaka Siddhānta.

to a complete revolution or, which comes to the same, that the sun had then performed a number of complete revolutions plus  $\frac{291765}{292207}$  of a revolution. Now in order to explain this kshepa we must ascertain according to what principles and starting from which period Varāha Mihira calculated the mean place of the sun on the 1st Chaitra Śaka 427. The principles are doubtless those on which the statement concerning the nature of the yuga and the general rule for calculating the sun's mean places are founded, and we can therefore be in no uncertainty as to the method of forming the ahargaṇa and calculating from it the madhyama Sūrya. Less certain is the epoch beginning from which the ahargaṇa is to be formed. If we try the different possibilities we find that neither the beginning of the Kaliyuga nor the end of the Kṛitayuga lead to the above-stated kshepa, that, however, a calculation starting from the beginning of the kalpa gives the desired result, although the course of procedure involves a few small irregularities. I will succinctly state the details of the calculation in order to facilitate its control. The sum of years (the varshagaṇa) from the beginning of the kalpa to the epoch of the karaṇa amounts to 1,955,883,606 (1,953,720,000 to the end of the kṛita, 2,160,000 for Tretā and Dvāpara, 3,179 from beginning of Kali to Śaka, 427 from Śaka to epoch of Karaṇa). From the varshagaṇa we deduce in the customary manner (availing ourselves, however, of the elements of the yuga as stated by Varāha Mihira, not of the corresponding elements of the known Sūrya Siddhānta) the adhimāsas, which we find to amount to  $721,384,203 + \frac{178734}{180000}$ . Instead of those we take, svalpāntaratvāt, 721,384,204 and thus obtain as the number of chāndra-māsas for the entire stated period 24,191,987,476. Multiplying this number by 30 we get the tithis from which we deduce, by means of the statement about the tithikshayas of the yuga, the number of the ishṭa kshayāha. We find  $11,356,023,206 + \frac{4941258}{6679167}$ . Instead of this we take 11,356,023,207 which deducted from the tithis gives for the ishṭa sāvana ahargaṇa 7,14,403,601,073. Multiplying this number by 800, according to the general rule about the mean places of the sun, and dividing by 292,207 we find that the sun has performed, from the beginning of the kalpa down to the epoch of the Pañchasiddhāntikā,  $1,955,883,606 - \frac{42}{292207}$  revolutions. The required kshepa is  $-\frac{442}{292207}$ . But now we have to remember that the ahargaṇa of the Sūrya Siddhānta gives the mean places of the planets at midnight at



Lañka while the rule of Varāha Mihira is, as we have seen, meant to give their mean places at noon. We therefore have to deduct from the mean place of the sun as found hitherto his mean motion for half a day, in order to obtain his mean place on the preceding noon. This mean motion for a day is  $\frac{800}{292207}$ , half of which is  $\frac{400}{292207}$ . Combining this

subtractive quantity with the one found above  $\left(-\frac{42}{292207}\right)$  we get

$-\frac{442}{292207}$ ; the exact quantity stated in Varāha Mihira's rule. The result has therefore justified the small assumptions made in the calculation of the ahargana; the latter will moreover receive additional confirmation from the rules about the mean places of the moon and the planets which will be discussed later on.

The period of 800 years comprising 292,207 sāvana days whereby to calculate the mean place of the sun is of frequent occurrence in Indian astronomical writings and tables. It is employed by Brahmagupta in the *Khaṇḍa-khādyā*. It is found in the Siamese astronomical rules which became known in Europe as early as 1688 and were first interpreted by Cassini. It is likewise used in the astronomical tables sent to France by the Père Patouillet and explained by Bailly in his *Traité de l'Astronomie Indienne et Orientale*, (p. 54; Discours préliminaire, p. xi).

The verse which in the *Pañchasiddhāntikā* follows next on the one explained above runs as follows :

नवशतसहस्रगणिते स्वरैकपक्षाब्धस्वरर्तुने ।

षड्भूनेन्द्रियनववसुविषयजिनेर्भाजिते चन्द्रः ॥

(In the first line we have to read ०स्वरर्तुने; in the second line, as will appear from the calculation, षट्भूनेन्द्रिय०; B. reads षड्भूनेन्द्रिय०.)

"Multiply (the ahargana) by 900,000, deduct 670,217 and divide by 24,589,506; the result is the mean place of the moon." The general rule about the mean places of the moon which is contained in this verse is easily explained from the statements on the yuga of the *Sūrya Siddhānta* which we have had occasion to consider. The yuga comprises 180,000 years. Multiplying these by 12 and adding the intercalary months we have 2,226,389 lunar synodical months. Again adding to these the 180,000 revolutions of the sun we get 2,406,389 as the number of the sidereal revolutions of the moon which take place in one yuga. (Dividing by the last number the sāvana days of the yuga we find as the length of the sidereal month  $27^d 7^h 43' 12.60''$ . The length of the sidereal month of the known *Sūrya Siddhānta* amounts to  $27^d 7^h 43' 12.64''$ ). From the fact of 2,406,389 sidereal revolutions of the moon

being contained in 65,746,575 days the mean place of the moon for any given ahargana might of course be deduced directly; smaller numbers were, however, desirable as facilitating the calculations, and Varāha Mihira therefore substituted the relation of 900,000 revolutions to 24,589,506 days which offers the advantage of a smaller divisor, and a not only smaller but also much simpler multiplier. The substitution involves indeed a slight inaccuracy since 900,000 revolutions of the moon take place in  $24,589,506 + \frac{746166}{2406389}$  days, the fractional part of which quantity is neglected in the general rule. The error which results therefrom is, although insignificant, not to remain uncorrected and Varāha Mihira adds therefore (after one intervening verse about the mean place of the moon's necha) the following rule :

अश्लेषयज्ञानिन्देः खार्कादिहृतानि मण्डलानि क्षेपम् ।

खाच्च दिग्गानि धनं खरदक्षयमादृते विकलाः ॥

"Multiply the (elapsed) revolutions of the moon by 51 and divide by 3,120; the (resulting) seconds are to be deducted (from the mean place of the moon as found by the general rule)." (The second part of the rule refers to the moon's necha). The correction stated here is easily accounted for. By a proportional calculation we find that the moon performs in  $\frac{746166}{2406389}$  of a day about 14,708 seconds of a circle. To

so much consequently the error resulting from the neglect of the fraction amounts for 900,000 revolutions. The error for one revolution is therefore equal to  $\frac{14708}{900000}$  seconds or, as Varāha Mihira prefers to ex-

press it, reducing both numbers by 288, to (about)  $\frac{51}{3120}$  seconds. The

explanation of the kshepa, 670,217 is not quite so simple as that of the solar kshepa. We of course again employ the kalpādy-ahargana which had led to a satisfactory result in the case of the sun's mean place. If we, however, proceed according to the general rule given by Varāha Mihira, multiplying that ahargana by 900,000 and dividing by 24,589,506 and finally applying the prescribed correction, we find that the remainder combined with the moon's mean motion for half a day does not equal the stated kshepa. The fact is that approximately correct rules and approximately accurate corrections are applicable to comparatively short periods, but become altogether misleading if periods of very considerable length as for instance the kalpādy-ahargana are concerned. In such cases we must discontinue the use of reduced factors and employ absolutely correct numbers. In the present instance we consequently have to employ the

number of lunar months and *sāvāna* days of the entire *yuga*. We multiply the *kalpādy-ahargana* as formed above by 2,406,389 (= the number of the sidereal revolutions of the moon in a *yuga*), divide by 65,746,575 (= number of *sāvāna* days), reject the quotient which expresses the complete revolutions and keep the remainder 65,157,822 which indicates that at the time of the epoch the moon had, in addition to the complete revolutions, performed  $\frac{65157822}{65746575}$  of a revolution or, which is

the same, that  $\frac{588753}{65746575}$  were wanting to a complete revolution. This fraction, in order to be capable of being introduced into the general rule must be turned into 24,589,506<sup>ths</sup>; which being done we obtain  $\frac{220197}{21589506}$ . To this quantity again we have to add half the amount of

the moon's daily mean motion =  $\frac{450000}{21589506}$  in order to find the mean place of the moon at noon instead of the following midnight. The addition of the two subtractive quantities gives — 670,197, which quantity differs by 20 only from the *kshepa* stated in *Varāha Mihira's* rule: the discrepancy to whatever reasons it may be owing is much too small to be taken into account; the difference in the mean place of the moon at the time of the epoch which results from it amounts to 1" 3" only.

The rule following next on the one referring to the mean motion of the moon teaches how to find the mean place of the moon's *uchcha*. A few unimportant emendations being made, it runs as follows :

नवशतगुणिते दद्याद्भस्विष्यगुणाभ्वर्तुयमपचान् ।

नववसुसप्तष्टाभ्वरनवास्त्रिभक्ते शशाङ्कोच्चम् ॥

"Add 2,260,356 to (the *ahargana*) multiplied by 900 and divide by 2,908,789; the result is the mean place of the *uchcha* of the moon."

From the general rule involved in the above viz. that 900 revolutions of the moon's *uchcha* take place in 2,908,789 days, it follows that one revolution occupies 3,231<sup>d</sup> 23<sup>h</sup> 42' 16.76". Comparing this period with the duration of the revolution according to the known *Sūrya Siddhānta* which amounts to 3,232<sup>d</sup> 2<sup>h</sup> 14' 53.1" we feel at once inclined to suspect that the difference of the two quantities which is rather considerable is not merely owing to *Varāha Mihira's* desire of establishing a rule offering facilities for practical calculations but results from a real discrepancy of the two *Sūrya Siddhāntas*. And a closer consideration of the point confirms this suspicion. According to the known *Sūrya Siddhānta* the *chandrocchcha* of the moon performs 488,203 revolutions in one *mahāyuga*. If we now, in order to ascertain the corresponding number of the

Sūrya Siddhānta known to Varāha Mihira, multiply the 1,577,917,800 days of the mahāyuga by 900 and divide by 2,908,789 we get as quotient nearly 488,219. Varāha Mihira's Sūrya Siddhānta therefore reckoned so many revolutions of the uchcha to one mahāyuga and it is of interest to remark that it therein exactly agreed with the doctrine of Aryabhaṭa (see the Aryabhaṭīya edited by Kern, p. 6). We finally test the exactness of our assumption by the calculation of the kshepa stated in Varāha Mihira's rule. Multiplying the kalpādy-ahargana as ascertained before by 488,219 and dividing the product by 1,577,917,800 (the number of the days of a yuga) we get as remainder 1226408787

$\frac{1226408787}{1577917800}$ . Converting the quantity which expresses the fraction of the revolution incomplete at the epoch of the karaṇa into 2,908,789ths in order to render it capable of being introduced into the general rule, we obtain for the numerator 2260805 (and a small fraction). From this positive kshepa we finally deduct 450 = half the daily motion of the uchcha in order to carry back the mean place to the preceding noon; the remainder 2,260,357 differs by one only from the kshepa stated in the rule. It thus appears that the number we had assumed for the revolutions of the uchcha according to Varāha Mihira's Sūrya Siddhānta is the right one. Varāha Mihira finally applies a correction which becomes necessary in consequence of reduced and slightly inaccurate figures having been employed in the general rule. The amount of this correction is stated in the second half of the verse quoted above शशविषयघ्नानौन्दो: etc., I am, however, unable for the present to account for it by calculation. The fault possibly lies with the corruption of the manuscripts.

The same chapter contains a rule for calculating the mean places of the moon's node; which I am, however, unable to explain. We therefore turn now to the 16th adhyāya which treats of the mean places of the so-called tāra-grahas. The text of this short adhyāya runs as follows :

एष निशार्धवन्त्यां ताराग्रहनिर्णयेऽकसिद्धान्ते । \*

तत्रिन्दुपञ्चक्रौ तुल्यगतौ मध्यमार्के । †

जीवस्य शताभ्यसं द्वित्रिमाग्नित्रिमागरैर्विभजत् ।

द्युगणं कुजस्य चन्द्राहतं तु सप्ताष्टपद्मम् । §

सौरस्य सहस्रगुणादतुरसशून्यर्तुपट्कम्निखेकेः ॥

\* A. B. ०वन्त्यां A. निर्णोर्कसि० B. ०ग्रहणकसि०

† A. मध्यमा० B. ०मार्केसा.

‡ B. निवस्य.

§ A. सप्ताष्टपद्मं

॥ B. सौरस्य A. गृहादतुरसस्य०

यत्कर्म तेभगणाः शेषा मध्ययज्ञाः क्रमेणैव । \*  
 दश दश भगणे भगणे संशोधास्त्यराः सुरेज्यस्य । †  
 मनवः कुजस्य देयाः शनेश्च वाणा विशोधास्तु । ‡  
 राशिचतुष्टयमंशद्वयं कलाविंशतिर्वसुसमेताः । §  
 नववेदाश्च विलिप्ताः शनेर्धने मध्यमास्त्येव (?) ।  
 अष्टौ भागा लिप्तर्नवः खमत्तौ गुरौ विलिप्ताश्च । ¶  
 क्षेपः कुजस्य यमतिथिपञ्चविंशच्च राश्याद्याः । \*\*  
 शतगुणिते बुधश्रीघ्रं खरनवसप्ताष्टभाजिते क्रमशः । ††  
 अत्रार्धपञ्चमास्त्यराश्च भगणाहताः क्षेपः । ‡‡  
 श्रितश्रीघ्रं दशगुणिते द्युगणे भक्ते खरार्णवाद्यियमैः । §§  
 अर्धैकादश देया विलिप्ता भगणसंगुणिताः । |||  
 सिंहस्य वसुयमांशः खरेन्द्वौ लिप्तिका ज्ञश्रीघ्रधनम् । ¶¶  
 शोधाः सितस्य विकलाः शशिरसनवपक्षगुणदहनाः । \*\*\*

(The few remaining verses of the adhyāya will be quoted below.)

"1. The determination of the (mean places of the) smaller planets (*i. e.*, the grahas except sun and moon) for midnight at Avanti is as follows :

"2. Mercury and Venus have the same motion with the mean sun.

"3. For Jupiter multiply the ahargana by 100 and divide by 433,232.

"4. For Mars multiply the ahargana by 1 and divide by 687.

"5. For Saturn multiply the ahargana by 1000 and divide by 10,766,066.

"6. The quotients are the entire revolutions, the remainders are the mean places of the planets in their order.

"7. For each revolution of Jupiter 10 tatparas (thirds, *i. e.*, sixtieth parts of a second) are to be deducted.

"8. 14 tatparas are to be added for each revolution of Mars ; 5 are to be deducted for each revolution of Saturn.

"9. 10. 4 signs, 2 degrees, 28 minutes and 49 seconds are to be added to the mean place of Saturn.

"11. 8 degrees, 6 minutes and 20 seconds are the additive quantity for Jupiter.

\* B. सद्यश्चगुणा १००० । चतुरस०

† B. दशशभगणे.

‡ B. नमवः कुकुचु दे० A. शोधाश्च

§ B. शोधाः स्युः

|| B. नववेदाश्च लिप्ताः शनेमध्यमस्त्येयम्.

¶ B. ०र्नवः शेषसौ गुरुवि०

\*\* A. जमति० B. तितिथि० शस्य.

†† B. ०णितं.

‡‡ A. ०हतः B. हतालिपा.

§§ A. B. द्विगुणे.

||| A. अर्धैका० B. ०लिप्तिका भ०

¶¶ A. खरोद्वौ B. खरेदेवौ.

\*\*\* A. B. शोसितस्य ०पक्षा० ०गणा०

"12. For Mars the additive quantity are 2 signs, 15 degrees, 35 minutes.

"13. For the Sīghra of Mercury, multiply the ahargana by 100 and divide by 8,797.

"14. There the kshepa amounts to the product of four and a half tatparas into the (unaccomplished) revolutions.

"15. For the Sīghra of Venus multiply the ahargana by 10 and divide by 2,247.

"16. To be added are ten and a half seconds multiplied by the revolutions.

"17. 28 degrees of Leo (*i. e.*, 4 signs plus 28 degrees) and 17 minutes are the additive quantity of the Sīghra of Budha.

"18. From (the Sīghra of) Venus are to be deducted 332,961 seconds."

Of these sixteen lines, lines 1 to 6 contain rules for the calculation of the mean places of the five planets. Lines 7 and 8 state what corrections have to be applied to the mean places of Jupiter, Mars and Saturn if calculated according to the rules previously laid down. Lines 9 to 12 inform us what quantities are to be added to the mean places calculated and corrected according to the preceding rules, *i. e.*, they state the mean longitudes of the planets at the epoch of the Karaṇa. Lines 13 to 16 contain the rules for calculating and correcting the mean places of the Sīghra of Mercury and Venus.

Let us now enter into details and compare the above statement regarding the planets' periods of revolution with what is known from other sources. Of Jupiter it is stated in line 3 that it performs 100 revolutions in 433,232 days; one revolution therefore occupies 4,332·32 days. This nearly agrees with the doctrine of the published *Sūrya Siddhānta* which counts 364,220 revolutions of Jupiter to 1 mahāyuga of 4,320,000 years, and consequently, the mahāyuga comprising 1,577,917,828 days, 1 revolution to 4,332·3,206,523 days. A small difference between Jupiter's periods of revolution according to the known *Sūrya Siddhānta* and the *Sūrya Siddhānta* of the *Pañchasiddhāntikā* results of course from the repeatedly mentioned fact of the yuga of the latter work comprising 28 days less. We therefore assume at first that the *Sūrya Siddhānta* of the *Pañchasiddhāntikā* also gave 364,220 revolutions to 1 yuga, and therefrom derive the exact

period of one revolution  $\frac{1577917800}{364200} = 4,332·3,205,754$ . From this it

appears that the general rule given above, according to which 1 revolution comprises 4,332·32 days, is inaccurate and stands in need of a correction. In order to ascertain the amount of the latter we take the difference of the accurate and the approximate periods of revolution = 0·0005754 and there-

from derive by means of a proportion ( $4,332\cdot3,205,754 : 360 = 0\cdot0005754 :$  ✕) that fractional part of a circle which Jupiter passes through in the  $0\cdot0005754$ th of a day. The result are  $10''$  of a circle. Thereby is explained the rule given in line 7 according to which  $10''$  for each revolution have to be deducted from the mean place of Jupiter resulting from line 3. We finally have to explain the *kshepa* stated in line 11. Multiplying the *kalpādy-ahargana* by 364, 220 and dividing by the days of a *mahāyuga* we find that from the beginning of the kalpa down to the epoch of the book, Jupiter had performed  $16490909 + \frac{1776393}{78895890}$  revolutions. The

fraction turned into degrees, minutes etc. gives  $8^{\circ} 6' 20''$  for the mean longitude of Jupiter at the time of the epoch. As according to line 1, the rules for the mean longitudes of the planets refer to midnight at Avanti, the deduction of half a day's mean motion which had to be made in the case of sun, moon and moon's apsis is not required here.

We next turn to Mars. According to line 4, 1 revolution of Mars takes place in 687 days. The round number clearly shows the rule to be only an approximate one, and it now becomes our task to ascertain the exact determination on which it is founded. According to the published *Sūrya Siddhānta*, Mars performs 1 revolution in  $686\cdot99,749,394$  days, and it so might appear that the approximate value 687 presupposes the more accurate value  $686\cdot9,974\ldots$  (if we neglect for the moment the small difference resulting from the slightly different number of the days of a *yuga* according to the two *Sūrya Siddhāntas*) and that consequently the *Sūrya Siddhānta* of the *Pañchasiddhāntikā*, as well as the known *Sūrya Siddhānta* counts 2,296,832 revolutions of Mars to 1 *mahāyuga*. But if on this assumption we try to explain the correction of Mars' mean place which is stated in line 8 and the *kshepa* mentioned in line 12, we are unsuccessful and conclude therefrom that our assumption has been premature. We therefore try the opposite course and proceed to deduce the number of revolutions which Mars performs in one *yuga* from the correction of fourteen *tatparas* for each revolution. If Mars, as the general rule teaches, performs  $360^{\circ}$  in 687 days, it passes through  $14''$  in  $0\cdot000124 \ldots$  of a day. This fraction has therefore to be deducted from the approximate period of revolution, 687 days, when the remainder,  $686\cdot999874 \ldots$  days, indicates the accurate period of revolution. By this again we divide the days of the *yuga* ( $1,577,917,800$ ). The quotient, 2,296,824, indicates that according to the *Sūrya Siddhānta* of the *Pañchasiddhāntikā*, Mars performs in one *yuga* 2,296,824 revolutions; which number agrees with that given in the *Āryabhaṭīya*, (p. 4) and likewise in the *Paulīśa Siddhānta* (Colebrooke's *Essays*, II, p. 365). This number finally explains the *kshepa* stated in line 12; for if we multiply by it the *kalpādy-ahargana*

and divide by the number of the days of a yuga, the remainder, which indicates the mean longitude of Mars at the time of the epoch, is  $2^{\circ} 15'$ .

Passing on to Saturn we find it stated in line 5 that 1000 revolutions of the planet occupy 10,766,066 days. One revolution therefore occupies 10766·066 days. The difference of this value from the corresponding value which results from the statements of the known *Sūrya Siddhānta*, viz., 10765·77307461, is too considerable for us to assume that the *Sūrya Siddhānta* of the *Pañchasiddhāntikā* should have agreed with the known *Sūrya Siddhānta* in reckoning 146,568 revolutions of Saturn to 1 mahāyuga. In order to find the number of revolutions actually acknowledged by the former work we therefore again have recourse to the correction of Saturn's mean longitude. As according to the latter (see line 8)  $5''$  have to be deducted for each revolution of Saturn, the period assumed for Saturn's revolution in the general rule is too short and has to be lengthened by the time which Saturn requires to pass through  $5''$  of a circle. That time amounts to 0·0007 ... of a day. This being added to 10766·066 and the days of a yuga being divided by the sum, 10766·0667, the quotient, 146,564, indicates the number of revolutions in one yuga. This result shows that here too the *Sūrya Siddhānta* referred to by *Varāha Mihira* agreed with the *Aryabhaṭīya* and the *Paulīśa Siddhānta* while it differed from the known *Sūrya Siddhānta*. Finally in order to explain the *kṣhepa* we multiply the *kalpādy-abargana* by 146,564 and divide the product by the days of a yuga. The result— $4^{\circ} 2' 28' 49''$ —indicates the mean longitude of Saturn at the time of the epoch in strict agreement with line 9.

We now turn to Mercury and Venus whose periods of revolution are treated in the Indian systems as revolutions of their *śighras* while the mean place of the two planets is supposed always to correspond to the mean place of the sun. The latter circumstance is mentioned in line 2. Lines 9 and 10 state the real period of revolution of Mercury and the rule for finding its mean longitude. A hundred revolutions are reckoned to 8,797 days; one revolution therefore occupies 87·97 days. The known *Sūrya Siddhānta* gives to one yuga 17,937,060 revolutions of Mercury; to one of the latter therefore 87·969702 days. So far it might appear that the two *Siddhāntas* agree with regard to the number of revolutions of Mercury; this supposition, however, does not confirm itself when we make use of the correction stated in line 14 for the purpose of deducing therefrom the number of Mercury's revolutions in one yuga. We find by proportion that Mercury takes 0·000005 of a day to pass through  $4·5''$  of a circle; we therefore subtract the fraction from 87·97 and divide by the remainder the days of a yuga, when the quotient, 1,793,700,



indicates the number of Mercury's revolutions. This number agrees neither with the one stated in the known *Sūrya Siddhānta* (17,937,060) nor with the doctrine of *Āryabhaṭa* who reckons 17,937,020 revolutions of Mercury to one yuga (*Āryabhaṭa*, p. 6) ; on the other hand it does not differ from the number assumed in the *Paulīśa Siddhānta* (Colebrooke, *Essays*, II, p. 365). Mercury's *kshepa* finally is stated in line 17. We multiply the *kalpādy-abargana* by 17,937,000 and divide by the days of a yuga. The result is  $146^{\circ} 17'$  and about  $6''$ ; the last quantity is not stated by *Varāha Mihira*.

We conclude with Venus. According to line 15 it performs ten revolutions in 2,247 days, consequently one revolution in 224.7 days. According to line 16 we have to add  $10.5''$  for each revolution to the mean place of Venus as calculated in line 15. Venus passes through so many seconds in 0.00182 of a day. We deduct this amount from 224.7 and divide by the remainder the days of the yuga. The quotient, 7,022,388, indicates the number of revolutions that Venus performs in one yuga, a number in which the *Sūrya Siddhānta* of the *Pañchasiddhāntikā* again agrees with the *Āryabhaṭīya* (p. 6) and the *Paulīśa Siddhānta*, while the known *Sūrya Siddhānta* reckons 7,022,376 revolutions of Venus to one yuga. Lastly to calculate the *kshepa* we multiply the *kalpādy-abargana* by 7,022,388 and divide by the days of a yuga. The result is  $8^{\circ} 27' 30'' 35''$ , which positive quantity is turned into a negative one by being deducted from an entire revolution or twelve signs. The remainder is  $3^{\circ} 2' 29' 25''$  which quantity is equal to 332,965 seconds. The text says 332,961 ; but most probably we have to read (in line 18) शर instead of शशि, which emendation would remove the discrepancy.

In addition to the rules translated and explained in the above the chapter on "*Sūrya Siddhānta, madhyagati*" contains a few more verses which as it appears state a so-called *bīja* to be applied to the positions of the planets resulting from the general rules. These verses, which together with those already quoted constitute the entire chapter, run as follows :

क्षेप्याः खरेन्दुविकलाः प्रतिवर्ष\* मध्यमक्षितिजे ।

दश दश गुरोर्विशोद्धाः शनिश्चरे सार्धसप्त द्युताः ॥

पञ्चाब्धयो† विशोद्धाः सिधे बुधे स्वाश्विचन्द्रयुक्ताः § ।

खखवेदेन्दुविकालिकाः शोद्धाः सुरपूजितस्य मध्यात् स्युः ॥

"Seventeen seconds for each year are to be added to the mean place of Mars ; ten to be deducted from that of Jupiter ; seven and a half to be

\* A. B. •वषमाध्य•

† A. पंचाब्धयो B. पंचद्वयो.

† A. •जो B. जोः

§ A. स्वाश्वि• •युताः

added to that of Saturn; forty-five to be deducted from that of Venus; one hundred and twenty to be added to that of Mercury. Fourteen hundred seconds are to be deducted from the mean place of Jupiter."

These corrections call for no special remarks. As in similar cases, no special reason is given for the amount of the correction, it being understood that corrections of just that value will bring about a satisfactory agreement between calculation and observation. It is not said with whom the *bija* originated; but we have no reason to doubt that it was Varāha Mihira himself who had perceived that the elements of the *Sūrya Siddhānta* did not fully satisfy the requirements of his time. It is moreover noteworthy that the corrections proposed by Varāha Mihira for the *Sūrya Siddhānta* do not differ very much from those proposed for the elements of the *Āryabhaṭīya* by Lalla who is called the disciple of Āryabhaṭa. The passage from Lalla which refers to this point is quoted in the commentary on the *Āryabhaṭīya* (Kern's edition, p. 58) and runs as follows:

शके नखाब्धिरहिते शशिनो ऽत्तदखैस्तनुजितः कृतशिवैस्समसप्षडङ्कैः ।  
 शैलाब्धिभिस्सुरगुरोर्गुणिते सितेऽक्षाच्छोधं त्रिपञ्चकुहते ऽधश्चाक्षिभक्ते ॥  
 सखेरमाब्धिरहिते चितिनन्दनस्य सूर्यात्मजस्य गुणिते ऽम्बरलोचनैश्च ।  
 बामाग्निवेदनिहते विदधौत लब्धं शैतांशुस्त्रनकुजमन्दकलासु दृष्टिम् ॥

"Deduct 420 from the *S'āka* year, multiply it, for the moon, by 25, for the moon's *uchcha* by 114, for *Rāhu* by 96, for Jupiter by 47, for Venus' *uchcha* by 153, for Mars by 48, for Saturn by 20 and (for Mercury's *uchcha*) by 430; divide in all cases by 250. The resulting (minutes) are to be added to the minutes (of the mean places) of Mercury, Mars and Saturn (while they are to be deducted in the case of the other planets)."

This means that—the moon with her apogee and node being left aside —  $\frac{47'}{250} = \text{about } 11''$  for each year are to be deducted from Jupiter's

mean place;  $\frac{53'}{250} = 36''$  are to be deducted from the mean place of Venus;

$\frac{430'}{250} = 103''$  are to be added to Mercury;  $\frac{48'}{250} = 11''$  are to be added to

Mars;  $\frac{20'}{250} = 5''$  are to be added to Saturn. It will be observed that

these corrections differ in no case very widely, in some hardly at all from those which Varāha Mihira proposes.

The last clause in Varāha Mihira's chapter on the mean motions of the planets according to which 1,400 seconds are to be deducted from the mean place of Jupiter must refer to a constant *bija* to be applied to

the place of the planet at the epoch of the *Karāṇa*. It is too considerable for being considered as a yearly *bīja*; a *bīja* of the latter kind for Jupiter has moreover been stated in the preceding verse already.

Having gathered all the information which the *Pañchasiddhāntikā* supplies regarding the mean motions of the planets according to the *Sūrya Siddhānta* we now turn to the *Romaka Siddhānta*.

The information regarding the *yuga* adopted by the *Romaka Siddhānta* is contained in the 15th verse of the first *adhyāya* :

रोमकयुगमर्केन्दोर्वर्षाण्यकाशपञ्चसुपलाः ।

खेन्द्रियदिशो ऽधिमसाः स्वरक्षतविषयाष्टयः\* प्रलयाः ॥

“The lunisolar *yuga* of the *Romaka (Siddhānta)* comprises 2,850 years; (in these) there are 1,050 *adhimāsas* and 16,547 omitted lunar days.”

The first point to be noted with regard to this passage is that the *yuga* is called “*arkendvoḥ*,” a lunisolar *yuga*, from which it might appear that the *yuga* of the *Romaka Siddhānta* comprised an integral number of revolutions of the sun and the moon only, while the *yugas* of the other *Siddhāntas* as for instance the *Sūrya Siddhānta* are founded on the revolutions of the other planets also. If this was really the case cannot as yet be settled with certainty. The *Pañchasiddhāntikā* indeed extracts from the *Romaka Siddhānta* information about the motions of the sun and moon merely; but on the other hand a passage in the *Brahmagupta Sphuṭa Siddhānta* which will be quoted later on shows that *Śrīṣheṇa* treated also of the other planets. That he, however, in the construction of his astronomical periods considerably diverged from the other *Siddhāntas* we are told by *Brahmagupta* himself in a passage occurring in the first chapter of his *Sphuṭa Siddhānta* :

युगमन्वन्तरकल्पाः कालपरिच्छेदकाः स्मृतावज्ञाः ।

यस्मान्न रोमके ते स्मृतिबाह्यो रोमकसंज्ञात् ॥

“Because the *yugas*, *manvantaras* and *kalpas* which are stated in the *Smritis* as defining time are not employed in the *Romaka (Siddhānta)*, therefore the *Romaka* stands outside *Smṛiti*.”

If we now inquire more closely into the nature of the period made use of in the *Romaka Siddhānta*, we observe at once that the number of the solar years as well as that of the intercalary months can be reduced by 150 so that we may say as well that 19 solar years contain 7 intercalary months or that 19 solar years contain 235 synodical months. In other words the *yuga* of the *Romaka Siddhānta* is founded on the well-known Metonic period. Nor is it a matter of great difficulty to

find out why the Romaka uses instead of the simple Metonic period its 150th multiple. At first we have to ascertain the length of the solar year of the Romaka, by dividing the 1,040,953 civil days comprised in the entire yuga by 2,850, the number of years; when we obtain  $365^d 5^h 55' 12''$ ; a result showing, as of course we might already have inferred from the mere use of the Metonic period, that the Romaka uses not the sidereal solar year the uniform employment of which is so marked a feature of later Indian astronomy but the tropical solar year. Nor again is there any room for doubt concerning the origin of this determination of the solar year. It is the tropical year of Hipparchus or if we like of Ptolemy who adopted his great predecessor's estimation of the time occupied by one tropical revolution of the sun without attempting to correct it although it is considerably too long. (Cf. Ptolemy's *Syntaxis*, Book III.)

It is certainly a matter of interest to meet in one of the oldest Siddhāntas with an estimation of the year's length whose Greek origin it is impossible to deny. The comparison of the length of the year as fixed by the different Siddhāntas on one side and the Greek astronomers on the other side is generally beset by considerable difficulties chiefly in consequence of the Hindú astronomers giving no direct information about the length of the tropical year, while the Greeks on their part speak in clear terms of the tropical year only, and oblige us to infer their opinions regarding the length of the sidereal year. It is of course easy enough to deduce the length of the one species of year from the length of the other if we are acquainted with the assumed yearly rate of the precession of the equinoxes. But it so happens that the determination of the latter point is in many cases by no means easy. To take for instance the (published) *Sūrya Siddhānta* we easily derive from its data the length of its sidereal year, viz.,  $365^d 6^h 12^m 36.6^s$  and, if we avail ourselves of the amount of yearly precession as stated in its *tripraśnādhya*, viz.,  $54''$ , we find for the length of the tropical year  $365^d 5^h 50^m 41.7^s$ , which is a determination much more correct than that of the Greek astronomers. But I quite share the suspicion expressed by Professor Whitney (translation of the *Sūrya Siddhānta*, p. 246 ff.) that the passage of the *tripraśnādhikāra* alluded to formed no part of the original *Sūrya Siddhānta*, but is a later interpolation. It remains therefore uncertain by what process the length of the sidereal year of the *Sūrya Siddhānta* was determined; the possibility of its being founded on the tropical year of Hipparchus and the Romaka Siddhānta is meanwhile not to be considered as altogether excluded.\*

\* The proposal made by Biot (*Études sur l'astronomie Indienne*, p. 29) to account for the sidereal year of the *Sūrya Siddhānta* by considering it as the

Hipparchus himself basing on his calculation of the tropical year and on the Metonic cycle constructed a period of 304 ( $4 \times 4 \times 19$ ) years minus one day = 111,035 days which period comprises 3,760 synodical months. (See Ideler's *Chronology*, I, p. 352.) The advantages of this period are that it comprises integral numbers of civil days and of lunar months and, very nearly, of tropical years while at the same time it implies nearly accurate estimations of the length of the year and the month, (*viz.*,  $365^d 5^h 55' 15''$  and  $29^d 12^h 44' 2.5''$ ; the accurate figures according to Hipparchus being  $365^d 5^h 55' 12''$  and  $29^d 12^h 44' 3.2''$ ). A period of this kind would, however, apparently not have suited Indian purposes. We here are met by one of the particular Indian requirements which helped to transform systems of Greek origin into the Indian systems with their strongly marked peculiarities. At the time when Greek astronomy began to act on India the calendar in prevalent use in the latter country was undoubtedly already the well-known lunisolar one with its tithis and intercalary lunar months. The peculiarity of this calendar is, that it does not inform one directly of the number of civil days which have expired from the beginning of the current year but only of the number of the elapsed lunar days or tithis. From the latter the number of civil days has to be derived by means of a proportion. And again in order to ascertain the number of tithis contained in a certain number of years antecedent to the current year, it is necessary at first to ascertain the number of intercalary lunar months which have occurred in the course of those years, a process requiring the employment of another proportion. We cannot enter in this place into a discussion of the reasons which may have led to the adoption of such an extraordinary and inconvenient style of calendar; for our purposes it is sufficient to know that it had established itself on Indian soil at an early period. It appears for instance in the *Jyotisha-Vedāṅga*, although the form in which it there presents itself is a comparatively simple and primitive one, the writer of the *Vedāṅga* neither having an accurate knowledge of the length of the revolutions of the sun and the moon nor being acquainted with the solar and lunar inequalities. At any rate it had taken a firm hold on the Hindú nation and when Greek notions and methods streamed in, they had to adapt themselves to the existing system. Thus the above described manner of calculating the number of civil days comprised in a certain period with its twofold transformation of solar years into lunar months and of lunar days into civil days required the establishment of

arithmetical mean taken between the sidereal year of Hipparchus and that of the Chaldeans has not much to recommend itself; the mean would not even be an accurate one.

periods containing integral numbers of all the different constituent elements, as otherwise the already laborious calculations would have become vastly more troublesome. For this reason the author of the Romaka Siddhānta formed his yuga of 2,850 years which is not only a multiple of 19 years, from which circumstance it follows that it comprises an integral number of intercalary months; but which in addition comprises as we have seen an integral number of civil days. That 150 is the smallest multiplier by which the desired purpose can be effected it is easy to see. The Romaka period has the additional advantage of being based on the exact tropical year of Hipparchus while the period of 304 years demands a lengthening of the year by 3 seconds.

From the verse translated above we moreover derive the length of the month according to the Romaka Siddhānta. Dividing the sāvana days of the yuga by the number of its synodical months we obtain for the length of one synodical month  $29^d 12^h 44' 2.25''$ . Further, adding to the number of the synodical months of the yuga the number of solar revolutions and dividing by the sum the number of sāvana days, we arrive at a periodical month of  $27^d 7^h 43' 6.3''$ . (It need not be mentioned that the periodical month of the Romaka is, like its year, a tropical one.) A comparison of these values with those assigned to the same periods by the Greek astronomers offers, owing to the particular nature of the case, no special interest. Hipparchus had found for the length of the synodical month  $29^d 12^h 44' 3.262''$ \* and this estimation might not improbably have been known to the author of the Romaka Siddhānta; but since, as we have seen above, the absolute equality of 19 solar years and 235 synodical months was insisted on, the length of the month had to be modified slightly.†

\* This is the value resulting from Hipparchus's lunisolar period (about which see the following note). Ptolemy, as pointed out by Biot, *Résumé de Chronologie Astronomique*, p. 401, derives his value of the synodical month from the same period, arrives, however, from unknown reasons at a result differing in the decimal places of the seconds ( $29^d 12^h 44' 3.333''$ ) and employs this value in all his subsequent investigations.

† The above remark on the synodical month of course applies to the periodical month likewise. Although, however, I do not wish to enter in this place into a detailed comparison of the Greek and Indian determinations of the length of the month the following hints as to the course of procedure of the chief Greek astronomers may find a place. The lunisolar period employed by Hipparchus and described by Ptolemy in the 2nd chapter of the 4th book of the *Syntaxis* sets 126,007 days plus one hour equal on one side to 4,267 synodical months and on the other side to 4,612 sidereal revolutions of the moon minus  $7\frac{1}{2}^\circ$ ; the same period is said to comprise 345 sidereal revolutions of the sun minus  $7\frac{1}{2}^\circ$ . On these equalities may be based in the first place a calculation of the length of the synodical month, in the second place

We now proceed to consider some verses which teach how to employ the general principles stated above for the purpose of calculating the mean places of sun and moon. They are found in the 8th adhyāya whose general subject is the calculation of solar eclipses according to the Romaka :

रोमकसूर्यो युगणात् खतिथिज्ञात् पञ्चकर्तुपरिहीणात् ।  
सप्तष्टकसप्तहतेन्द्रियेद्धताश्चधमाः क्रमशः ॥

(Without entering on the discussion of a few necessary emendations of the above text I at once proceed to render its undoubted sense.) "Multiply the ahargana by 150, subtract from it 65 and divide by 54,787; the result is the mean place of the sun according to the Romaka." (From one of the following verses we see that the mean places of the Romaka are calculated for the time of sunset at Avantī.) I wish, with regard to the above verse as well as those verses which will be translated later on, to confine myself to the general part of the rule and not to enter for the present on a discussion of the additive quantity—the kshepa—which as we have seen when considering the corresponding rules of the *Sūrya Siddhānta* is introduced for the purpose of enabling us to start in our calculations from the epoch of the karaṇa. The additive—or in this case subtractive—quantity (—65) being left aside the remainder of the rule presents no difficulties. As we have seen above the

a calculation, independent from the former one, of the length of the sidereal month and the sidereal year. Ptolemy when determining the mean motions of the moon exclusively avails himself of the first mentioned equation between 126,007 days *plus* one hour and 4,267 synodical months and—employing the mean tropical motion of the sun settled independently—derives therefrom the mean tropical motion of the moon. From the latter it is easy to calculate the length of the periodical (tropical) month, with the result 27<sup>d</sup> 7<sup>h</sup> 43' 7.27", and from that again, if we avail ourselves of the value of the yearly precession which Ptolemy had accepted, *viz.*, 36", the value of the sidereal month, for which we find 27<sup>d</sup> 7<sup>h</sup> 43' 12.1". (Thus also in the Comparative Table of the sidereal revolutions of the planets, Burgess—Whitney's translation of the *Sūrya Siddhānta*, p. 168.) Hipparchus on the other hand who had not settled a definite value of the annual precession would, in order to ascertain the duration of the sidereal month, most probably have made use of the second of the above-mentioned equations. The resulting length of the sidereal month is 27<sup>d</sup> 7<sup>h</sup> 43' 13.57" (thus also Biot *études sur l'astronomie Indienne*, p. 44). A certain rate of the precession may be derived from comparing this sidereal month with the tropical month mentioned above (regarding whose length Ptolemy and Hipparchus agree if we set aside the insignificant difference resulting from the inadvertence of Ptolemy remarked on in the preceding note). Or again the rate of the precession may be calculated by comparing the length of the sidereal year which results from the third of the stated equations (*vide* 365<sup>d</sup> 6<sup>h</sup> 14' 11.79") with the duration of the tropical year; we thus obtain for the annual rate 46.8".

sun performs 2,850 revolutions in 1,040,953 days. Both numbers can be reduced by 19. In order therefore to find the place of the sun at a given time or, in Indian terminology, for a given ahargana, we multiply the ahargana by 150 and divide the product by 54,787. The result represents the mean place of the sun in the tropical sphere.

In the same adhyāya we read the following rule for calculating the mean place of the moon :

खक्षपाद्युगुणष्टवक्रताष्टनवकैवर्जिताद् द्यगणात् ।  
विविधवेचक्षकताशपरिशुद्धान्मध्यमशीतांशैः ॥

(The translation will show what emendations of the text are required.) “Multiply the ahargana by 38,100, subtract 1,984 and divide by 1,040,953 ; the result is the mean place of the moon.”

The kshepa being set aside the rule is easy to understand. The multiplier is the number of the sidereal months contained in the yuga of the Romaka Siddhānta ; the number of the civil days of the same period forms the divisor. The quotient represents the mean place of the moon in the tropical sphere.

While the preceding rules regarding the mean places of sun and moon gave no information about the elements of the Romaka which we might not have directly derived from the statement concerning the nature of the yuga and were chiefly interesting as confirming the latter, a new element is furnished by the next following verse which refers to the anomaly of the moon :

शून्यैकैकाभ्यस्तान् नवशून्यरसान्वितादिनसमूहान् ।  
रूपचिखगुणभक्तान् केन्द्रं शशिनो स्लगमे ऽन्यथा ॥

(Without translating the compound which refers to the kshepa, and only remarking that the last words are an emendation of शशिनोस्लगमेवद्यां which is the reading exhibited by the manuscripts we render :) “Multiply the ahargana by 110 and divide by 3,031 ; the result is the moon's kendra at the time of sunset at Avanti.”

The last words indicate the time of the day from which the calculations according to the Romaka Siddhānta have to start and the Meridian employed ; they will not be considered here as they are important only if viewed in connexion with the kshepa. The kendra performing 110 revolutions in 3,031 days we obtain by division  $27^d 13^h 18' 32.7''$  as the time of one revolution of the kendra or, according to the Greeks' and our own terminology, of one anomalistic month. The manner in which we are here taught to calculate the moon's mean anomaly seems to be another interesting proof of the Romaka Siddhānta standing in a specially close relation to Greek astronomy. The Indian systems in general



do, as is well-known, not speak of revolutions of the moon's anomaly but of revolutions of the *uchcha*, *i. e.*, the apogee or the apsis, while the Greeks combined the motion of the apogee and that of the moon herself in the so-called restitution of the anomaly (*ἀποκατάστασις τῆς ἀνωμαλίας*) which corresponds to the modern anomalistic month and which we here meet with in the *Romaka* as the revolution of the *kendra*. I am aware that Hindu Astronomers occasionally calculate the position of the *kendra* in the same way, *i. e.*, without having recourse to the separate revolutions of the *uchcha*, and moreover it might be said that *Varāha Mihira* who reproduces the systems of his predecessors in a greatly condensed shape may have modified the rules of the *Romaka Siddhānta* in this special point, merely aiming at giving rules the results of which would be identical or nearly identical with those of the *Romaka*. But against this it is to be urged that in the next following chapter which treats of the calculation of eclipses according to the *Sūrya Siddhānta* we meet with a rule for calculating the place of the *uchcha* which exactly agrees with the *Sūrya Siddhānta* as known to us, and that therefore *Varāha Mihira* who faithfully reports the doctrine of one *Siddhānta* regarding this particular point may be expected to have done the same with regard to the other. Remembering therefore that in other points also, as shown above, the *Romaka Siddhānta* evinces more unmistakable traces of Greek influence than the remainder of the *Siddhāntas*, we shall most probably not err in considering its peculiar method of calculating the moon's mean anomaly as due to Greek models, while on the other hand the employment of separate revolutions of the *uchcha* as exhibited in the *Sūrya Siddhānta*, etc. has to be viewed as an Indian innovation.

The rates of mean motion of the moon and her *uchcha* can of course be deduced from the rules extracted and translated in the above; they are, however, specially stated in another verse of the same chapter :

चनवनगाः शशिभुक्तिः क्षतवस्तुमुनयः शशङ्ककेन्द्रस्य ।

“The (mean daily) motion of the moon is 790 (minutes); of the moon's anomaly 784 (minutes).”

These are of course mere “*sthūla*” values, of sufficient accuracy, however, for ordinary purposes.

The value of the anomalistic month which results from Hipparchus's lunisolar periods is  $27^d 13^h 18' 34.7''$ . The small difference between this value and the one adopted by the author of the *Romaka Siddhānta* may be owing to the latter's wish to establish a not over long period containing integral numbers of revolutions of the *kendra* and of civil days.

We finally have to consider a verse which contains the rule for calculating the mean place of the moon's node. The latter part of the text of the verse is very corrupt :

षष्टकगुणिते दद्याद्रसर्तुयमषट्कपक्षकान् राहोः ।  
भवरूपाग्राष्टिहते क्रमादुक्तान् चये वक्तुं\* ॥

We are concerned only with the first half of the first line and the first half of the second line. The second half of the first line states the *kshepa* whose consideration we exclude; the second half of the second line is corrupt (the वक्तुं, however, clearly indicates that the motion of the node is retrograde). “Tryashtaka” has to be taken as meaning 24. The rule therefore directs us to multiply (the *ahargana*) in the case of *Rāhu* by 24 and to divide by 163,111. From this it appears that the *Romaka* reckons 24 revolutions of the node to 163,111 days; one revolution therefore comprises 6,796<sup>d</sup> 7<sup>h</sup>. This agrees very nearly with Ptolemy’s determination (which we calculate from the mean daily motion of the node as determined by him) according to which one revolution of the node takes place in 6,796<sup>d</sup> 14<sup>h</sup>, etc.†

From these statements regarding the *yuga* of the *Romaka Siddhānta* we now turn to the practical rule concerning the calculation of the *ahargana* which is contained in the 8th, 9th and 10th verses of the first chapter where it follows immediately on the introductory verses quoted and translated above.

सप्तशिवेदसंख्यं शककालमपास्य चेचशुक्लादौ ।  
अर्धास्त्रिमिते भानौ यवनपुरे सौम्यदिवसाद्ये ।  
मासीकृते समासे द्विष्टे सप्तारहेते ऽष्टयमपत्तैः ।  
लब्धैर्युतो ऽधिसासैस्त्रिंशद्ब्रह्मस्त्रियुतो द्विष्टः ।  
रुद्रहः समनुशरे लब्धेनो गुणस्त्रयसप्तभिर्द्युगणः ।  
रामकसिद्धान्ते‡ ऽयं ज्ञानिचिरे पौलिशे ऽप्येवम् ॥

“Deduct the Saka year 427, (*i. e.*, deduct 427 from the number of that Saka year for any day in which you wish to calculate the *ahargana*) at the beginning of the light half of Chaitra, when the sun had half set

\* So in B. A. has over क्कसा a rather indistinctly shaped letter which may be a द or perhaps an र and after that खात्तव्यते.

† We may notice here a mistake which has crept into the Comparative Table of the Sidereal Revolutions of the planets in Burgess—Whitney’s translation of the *Sūrya Siddhānta*, p. 168. The compiler of that Table when calculating the sidereal revolution of the node according to Ptolemy and the moderns apparently forgot that, the motion of the node being retrograde, the effect of the procession of the equinoxes is to render the sidereal revolution of the node not longer but shorter than the tropical revolution; he therefore added the difference due to the procession to the tropical revolution instead of deducting it. The real value of the sidereal revolution of the node according to the moderns is 6,793<sup>d</sup> 10<sup>h</sup>, etc., and rather less than this quantity according to Ptolemy.

‡ A. B. •सिद्धान्तो.

in Yavanapura, at the beginning of Wednesday; turn (the number of solar years remaining after the deduction of 427) into months, add the months, (*i. e.*, the elapsed lunar months of the current year), put the result down in two places, multiply it (in one place) by 7 and divide by 228, add the resulting *adhimāsas* (to the number of months obtained above); multiply the sum by 30, add the *tithis*, (*i. e.*, the elapsed *tithis* of the current month), put the result down in two places; multiply it (in one place) by 11, add 514 and (divide) by 703; deduct the quotient (from the number of *tithis* found above). The final result is the (*sāvana*) *ahargana* according to the Romaka Siddhānta; in the Paulīśa too it is not very much different."

The above is a very concisely stated rule for a rough calculation of the *ahargana*, *i. e.*, the sum of civil days elapsed from a certain epoch down to a given date. The general principles of the calculation do not differ from the usual ones and therefore stand in no need of elucidation. Concerning the details we have in the first place to notice that the Saka date 427 has to be deducted from the given sum of years. This means of course that the *ahargana* is to be calculated from the end of the 427th year of the Saka era. The question remains whether 427 Saka elapsed is to be taken as the time when the Romaka Siddhānta was written or at least is the epoch fixed upon by the author of the Romaka Siddhānta as the starting-point of his calculations, or whether the named year represents either the time of the composition of the *Pañchasiddhāntikā* or the epoch selected by Varāha Mihira himself. The former alternative is indeed *primā facie* the much more probable one as the date appears in the text in connexion with other details which certainly originally belonged to the Romaka and not to Varāha Mihira. The latter alternative can, however, not be rejected altogether; for it is by no means impossible that while the principles of the calculation of the *ahargana* are taken from the Romaka, the particular date from which it starts might have been chosen by Varāha Mihira himself. It is moreover the habit of the writers of *karana-granthas* to take for their epoch either the year in which their book is actually composed or at least some very near year. And finally Albīrūnī as well as the Hindū Astronomers of Ujjain who in the beginning of this century furnished Dr. W. Hunter with the list of astronomers published by Colebrooke (*Algebra*, p. xxxiii) took 427 as the date of Varāha Mihira himself (*Cf.* Kern, Preface to the *Bṛihat Saṃhitā*, p. 2.) On the other hand as Prof. Kern points out, it is certainly most improbable that Varāha Mihira whose death has been ascertained by Dr. Bhau Daji to have taken place in 587 A. D. should have written the *Pañchasiddhāntikā* in 505 already. The other argument adduced by Prof. Kern against 505 being the date of the *Pañchasiddhānt*

tikā is that the latter work quotes *Ārya Bhaṭa* who was born in 476 only and therefore is not likely to have been referred to in 505 already as a writer of authority. Matters lie, however, somewhat differently. We know from a passage of *Brahmagupta* which will be quoted later on, that *Śrīsheṇa* the author of the *Romaka Siddhānta* had borrowed some of the fundamental principles of his astronomical system from *Āryabhaṭa*. Now *Āryabhaṭa*'s first work (for it is not likely that he began to write before the age of twenty-three) having been composed in 499, the assumption that 505 marks the time of the *Pañchasiddhāntikā* would compel us to conclude that *Śrīsheṇa*'s work was written in the short interval between 499 and 505, and had then already become famous enough to be esteemed one of the principal five *Siddhāntas*. Such a conclusion does certainly not recommend itself, and we may safely I think assume that 505 is either the year in which *Śrīsheṇa*'s work was written or else the year selected by him for the starting-point of his calculations, and therefore not far remote from the year in which he wrote. For the date of the *Pañchasiddhāntikā* there would finally remain the period from 505 to 587. I should, however, be unwilling to assign it to a later date than perhaps 530 to 540; for if its composition was removed by too great an interval from 505, it is improbable that *Varāha Mihira* should have kept the latter year as his epoch and not have introduced a more recent one.

We return to the *ahargana* rule. The days are to be counted from sunset, a practice which we do not elsewhere meet with in India while it is known to have been generally followed by the Greeks; another proof for the particularly intimate dependance of the *Romaka* on Greek science. The years which have elapsed from the epoch are turned into months (in the usual way, by being multiplied by 12) and the elapsed months of the current year are added. Then by a proportion resulting from the *yuga* of the *Romaka* the intercalary months are calculated (7 intercalary months are to be added to 228 months; how many to the given number of months?). The number of the months is, then multiplied by 30, and from the number of *tithis* found in that way the number of omitted lunar days (*tithi kshaya*) is derived by another proportion, which is, however, merely approximate. Since, as we have seen above, the *Romaka* reckons 16,547 omitted lunar days to the *yuga* (which comprises 1,057,500 *tithis*), 703 lunar days comprise

$11 + \frac{41}{1057500}$  omitted lunar days, while the proportion made use of

for the calculation of the *ahargana* neglects the fraction. The additional quantity 514 does not occupy us because, as stated above, we exclude for the present the consideration of the epoch of the *Romaka Siddhānta* and the *kshepa*-quantities connected with it.

An identical rule for the calculation of the *ahargana* is not found anywhere else in Indian astronomy (as indeed it cannot be on account of the prevailing employment of the sidereal solar year) with one exception. The rules of Siamese astronomy which have been alluded to above teach the calculation of the *ahargana* (or as it is called there *horoeonne*—I quote from the account of Siamese astronomy given by Bailly in his *Traité de l'astronomie Indienne et Orientale*) according to exactly the same method. The *kshepa*-quantities differ on account of the Siamese rules starting from a different epoch. But the proportions  $\frac{7}{228}$  and  $\frac{11}{703}$  are both made use of. The use of the latter proportion is of no particular interest; for the proportion is only approximately correct, and does not allow of any certain inference regarding the length of the synodical month being founded on it. It is in fact—if I am not mistaken—occasionally used by *karana* writers who deal with the sidereal year only. But the former proportion as clearly pointing to a tropical solar year is noteworthy, all the more as the Siamese rules nowhere directly acknowledge the tropical year but uniformly employ the sidereal one. It did in fact not escape the attention of Cassini who inferred from it that a tropical year of  $365^d\ 5^h\ 55^m\ 13^s\ 46'''$  had originally been known to the Siamese, and remarked that such a year differed by two seconds only from Hipparchus's year. We are now able to maintain that the two years originally did not differ at all, and that the later small divergence is merely due to the inaccurate proportion  $\left(\frac{11}{703}\right)$  which for reasons of convenience was preferred to the accurate one.

We finally have to consider an interesting stanza in the 11th chapter of Brahmagupta's *Sphuṭa Siddhānta* which contains some information about the sources from which the elements of the *Romaka Siddhānta* were derived. The two manuscripts of the *Sphuṭa Siddhānta* at my disposal are unfortunately so incorrect that only a part of the stanza is intelligible; what interests us more particularly can, however, be made out I think. One manuscript (containing the text of the *Sphuṭa Siddhānta* only) reads:

युक्त्यर्थभटोक्तानि प्रत्येकं दूषणानि धोञ्चानि ।  
 त्रींशत्प्रभृतौनां कानिचिदन्यानि वक्ष्यामि ॥  
 लाटार्यशशङ्कौ मध्याविन्दूच्चपातौ च ।  
 कुजबुधश्रीघ्नवृक्षस्यतिसितश्रीघ्नशनैश्चरान् मध्यान् ।  
 युगपातवर्धभगणान् वासिष्ठाभदेन युगादिज्ञतपादात् ।  
 मन्दोच्चपरिधिपातस्यष्टीकरणाद्यमर्थभटोक्तम् ।  
 त्रींशत्तेन मृद्वीलारघ्नोच्चपरोमकात् ज्ञतः कथा ।

The other manuscript (E. J. H. 1304) which contains parts of the *Sphuṭa Siddhānta* with the commentary by *Prithūdaka Svāmin* reads :

Comm. : यानि संभवन्ति तान्यार्यभट्टदूषणानि औषेणादीनां येऽज्यानि इत्येतदार्ययाच ।

Text : युक्त्यार्यभट्टोक्तानि प्रत्येकं दूषणानि येऽज्यानि ।

औषेणप्रभृतौनां कानिचिदन्यानि वक्ष्यामि ॥

Comm. : गतार्थेयमार्या । इदानीं औषेणाचार्येण छतो रोमकसिद्धान्तो यच्च वासिष्ठो विष्णुचंद्रेण यतो दूषणमार्थाचतुष्टयेनाच ।

Text : आर्यान्मर्यशर्मांको मध्याविंदूषचंद्रपातो च । कुजबुधशीब्रवृहस्पतिसितशीघ्र-  
सनिस्ररान् मध्यान् । युगयातवर्षे भगणान्वासिष्ठान्विजयनंदिहृतपादान् । मंदोच्चपरिधिपा  
तान्दृष्टीकरणाद्यमार्थभटात् । औषेणेन गृहीत्वा रचोच्चारोमककृतकर्षः इत्यादि ।

What chiefly concerns us in the above extract (the text of which it is not possible to emendate in all places without the help of further manuscripts) is the fact of *Aryabhaṭa* and *Lāṭa* being mentioned among the predecessors of *Srīsheṇa*. The *Romaka Siddhānta*, in that shape at any rate which was given to it by *Srīsheṇa*, is therefore later than *Aryabhaṭa* and was as we have remarked above most probably composed in 505. It borrowed from *Aryabhaṭa*, as we see from the line मंदोच्च\*, all those processes which are required for finding the true places of the planets. On the other hand it adopted from *Lāṭa* all those rules by means of which the mean places of the planets are calculated.\* *Lāṭa* therefore appears to have been that Hindū astronomer who first borrowed from the Greeks the tropical year of *Hipparchus*, the *Metonic* period, etc. This would agree very well with the other notice, quoted above, which the *Pañchasiddhāntikā* furnishes concerning *Lāṭāchārya*, viz., that according to him the beginning of the day was to be reckoned from the moment of sunset in *Yavanaṃpura*. It is greatly to be regretted that the *Pañchasiddhāntikā* does not treat of the mean motions of the planets other than sun and moon according to the *Romaka Siddhānta*; as these also were, according to *Brahmagupta*, borrowed from *Lāṭa* they would most likely correspond with the mean motions as determined by *Hipparchus* more closely than the mean motions resulting from the cycles of the *Sūrya Siddhānta* and the *Aryabhaṭīya*. If the *Romaka Siddhānta* by *Srīsheṇa* was composed in 505 as appears very likely *Lāṭa* would have to be considered at least as a contemporary of *Aryabhaṭa*; but considering the specifically Greek character of his astronomy I think it much more likely that he preceded him.

\* The reading आर्यान्म\* of the E. J. H. manuscript (instead of लाटाक्ष\* of the other manuscript) is clearly wrong. In the first place *Arya* could hardly be used for *Aryabhaṭa*; secondly, the mean motions of the *Romaka* are not those of *Aryabhaṭa*; thirdly, the indebtedness of the *Romaka* to *Aryabhaṭa* is stated in the later line मंदोच्चपरि\*.

A doubt concerning Lāṭa's position might arise from the introduction of the *Pañchasiddhāntikā* in which it is remarked that the Paulīśa and Romaka Siddhāntas were "vyākhyātau" by Lāṭadeva. This Lāṭadeva is either to be considered as a writer altogether different from that Lāṭa to whom Śrīsheṇa was indebted for a part of the elements of his Siddhānta, or else we must suppose that Śrīsheṇa's Romaka Siddhānta was only a recast of an older Romaka Siddhānta which was written or commented on by Lāṭa. The latter remark perhaps applies to the Paulīśa Siddhānta also, and we must here remember that, as Prof. Kern has shown, Utpala distinguishes between the Paulīśa Siddhānta and a Mūla Paulīśa Siddhānta.

We may in conclusion sum up in a few words the chief results following from the consideration of those parts of the *Pañchasiddhāntikā* which form the subject of this paper. In the first place it appears that the rules of the Sūrya Siddhānta known to Varāha Mihira differed very considerably from the corresponding rules of the Sūrya Siddhānta which has come down to us while they agreed partly with the Āryabhaṭīya partly with the Paulīśa Siddhānta as represented by Bhāṭṭotpala. It follows that in any inquiries into the earliest history of modern Indian astronomy the existing Sūrya Siddhānta is not to be referred to, at any rate not without great caution. In the second place we are enabled, by what we have learned about the Romaka Siddhānta, to go back beyond Āryabhaṭa and the Sūrya Siddhānta, and to gain an insight into the very beginning of modern Hindū science when it still wore the unmistakable impress of its Greek prototype and had not yet hardened into its distinctive national form.

## APPENDIX.

I take this opportunity of showing by some more examples how practical Hindū works on astronomy facilitate their calculations by at first employing greatly reduced numbers and afterwards making up for the resulting errors by applying corrections. In the astronomical tables alluded to in the preceding paper which Bailly calls the tables of Narsapur, a period is employed for the calculation of the moon's mean place which is yet considerably simpler than the one which according to Varāha Mihira may be constructed on the elements of the Sūrya Siddhānta. We are there directed to multiply the *ahargana* by 800 and to divide by 21,857. Eight hundred revolutions of the moon comprising 21,857 days, one revolution would be equal to  $27^d 7^h 42' 36''$ . But a correction is stated to the effect that the given *ahargana* is to be divided by 4,888 and the quotient, taken as indicating degrees, is to be deducted from

the mean place of the moon as found from the general rule. This is as much as saying that  $\frac{1}{4888}^{\circ} = 0.7365''$  for each day of the *ahargana* are to be deducted. Multiplying this quantity by the duration of the periodical month as stated above ( $27^{\text{d}} 7^{\text{h}}$  etc.) we obtain  $20.1218''$ . So many seconds of the circle are passed through by the moon in  $36.65''$ . We add the latter quantity to the duration of the month and thus obtain  $27^{\text{d}} 7^{\text{h}} 43' 12.65''$ , which is almost identical with that duration of the sidereal month which results from the elements of the published *Sūrya Siddhānta* and differs very little only from the duration of the month presupposed by the *Sūrya Siddhānta* of the *Pañchasiddhāntikā*. Bailly supposes that that estimation of the month which results from 800 revolutions being considered equal to 21,857 days was the original one, and that the stated correction was added later for the purpose of bringing about an equality between the results of the tables of Narsapur and the tables of Krishnapur (which are likewise described by Bailly, *Traité*, etc., p. 31 ff.). But matters have doubtless to be explained differently. The author of the tables of Narsapur was acquainted with the *Sūrya Siddhānta* from which he derived his knowledge of the length of the sidereal month. He, however, aimed at replacing the inconveniently big numbers of the *Sūrya Siddhānta* by smaller ones—in the same way as *Varāha Mihira* does in his account of the *Sūrya Siddhānta*, went, however, a step further than the latter astronomer by reducing the period of 900,000 revolutions to its 1125th part, i. e., 800 revolutions. Dividing the 24,589,506 days of the former period by 1,125 we get  $21857 + \frac{381}{1125}$ . The moon's mean place is then calculated at first without the fraction being taken into account; but the error arising from this neglect is too considerable to be neglected, and so the above stated correction is applied finally.—We have to account in an analogous manner for the origin of the correction of the sun's mean place which the tables of Narsapur apply (Bailly, p. 51). The period comprising 800 revolutions of the sun which is employed there immediately presupposes a year of  $365^{\text{d}} 6^{\text{h}} 12' 36''$  while the year of the *Sūrya Siddhānta* is longer by  $0.56''$ . To make up for this difference  $2''$  for each period of 87 years are deducted from the sun's mean place as calculated from the 800 year period. For if the year has been estimated  $0.56''$  short of its real length the error amounts in 87 years to  $48.7''$ , and in so much time the sun passes through two seconds of the circle. It thus appears that here again the correction had not the aim of reconciling two sets of astronomical tables but was contemplated by the author of the Narsapur tables at the outset.



## ADDENDUM

(To Mr. V. A. Smith's paper on the Gupta Coins, p. 119.)

Coins lately procured by Mr. H. Rivett-Carnac, C. S., C. I. E. in Benares bazar :—

1. Chandra Gupta I ; King and Queen type ; legends legible ; as Plate II, 2. A good specimen.
  2. Chandra Gupta II ; Archer Type lotus-seat reverse, as Plate III, 1.
  3. Kumāra Gupta Mahendra ; Archer Type ; <sup>कु</sup>मा under arm, on margin 'Mahārāja' ;  
<sub>rev. as usual.</sub> <sup>र</sup>
- Obv. differs in legend, and in pose of figure from Plate III, 10. A fine specimen.

## ERRATA.

- P. 119, l. 19 read Ghatotkacha, for Ghatot Kacha, and so throughout Mr. Smith's paper on the Gupta coins.
- „ 128, „ 24 omit 'or jalampa.'

# Plate II



Fig 1



Fig 2



Fig 3



Fig 4



Fig 5



Fig 6



Fig 7



Fig 8



Fig 9



Fig 10



Fig 11



Fig 12



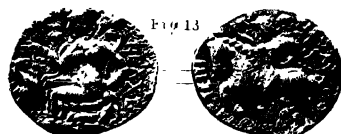
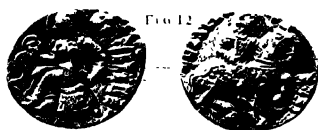
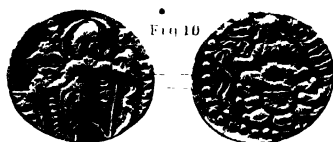
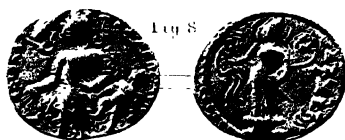
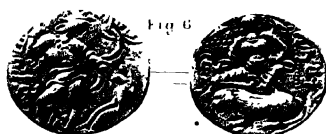
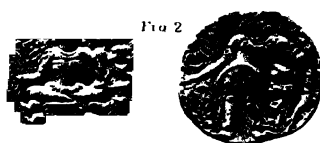
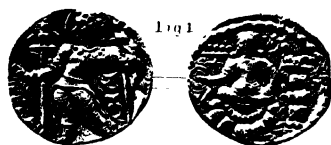
Fig 13



Fig 14

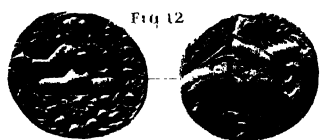
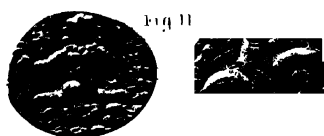
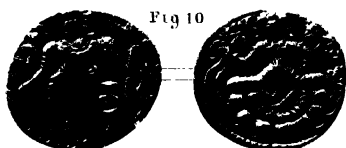
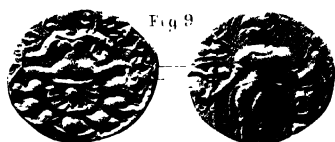
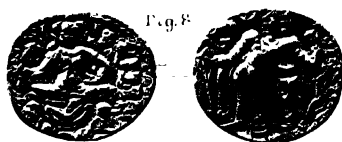
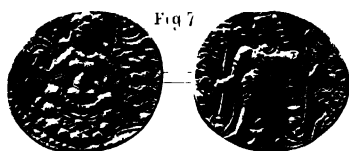
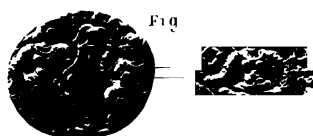
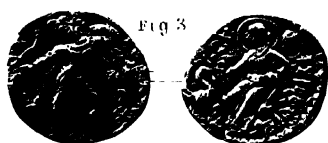
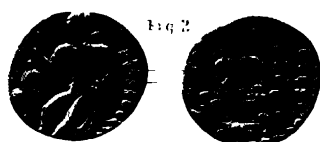
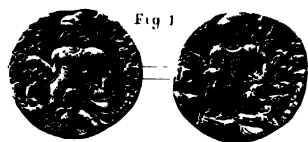
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SELECT GOLD COINS OF THE  
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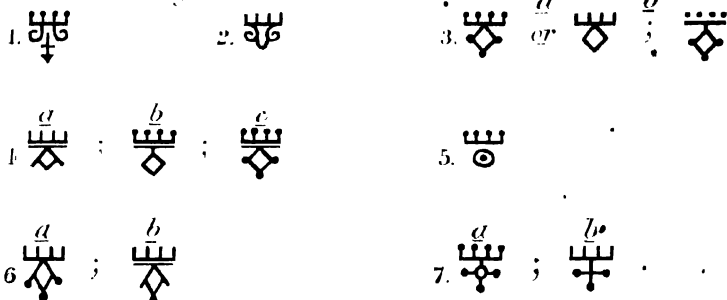


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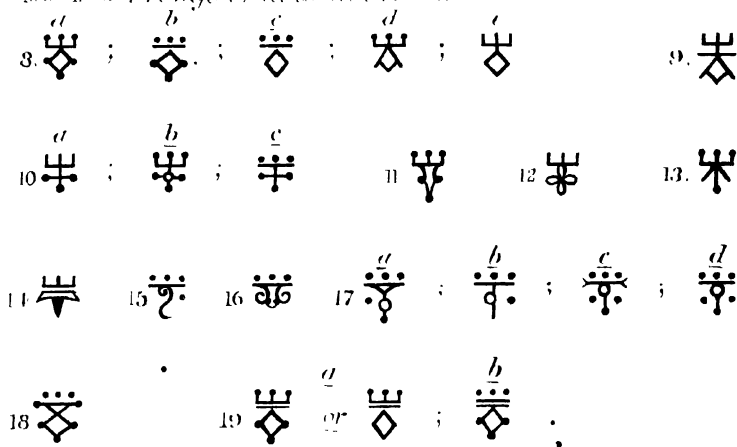


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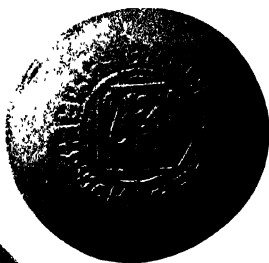








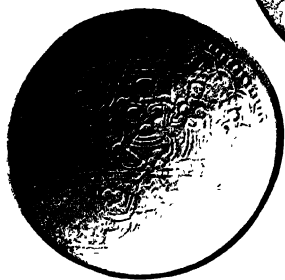
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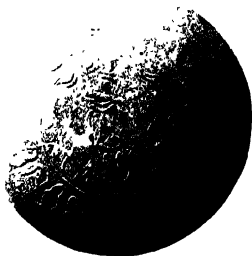
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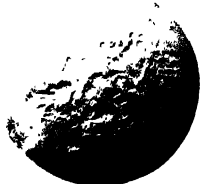
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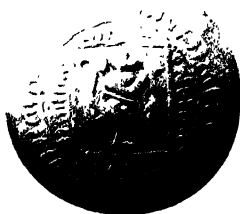
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JOURNAL  
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(Nos. I and II, 1884: with six Plates and a Map; and with a  
Special Number as substitute for Nos. III and IV).

EDITED BY

THE PHILOLOGICAL SECRETARY.

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"It will flourish, if naturalists, chemists, antiquaries, philologers, and men of science in different parts of *Asia*, will commit their observations to writing, and send them to the Asiatic Society at Calcutta. It will languish, if such communications shall be long intermitted; and it will die away, if they shall entirely cease." SIR WM. JONES.

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JOURNAL



# ASIATIC SOCIETY OF BENGAL

## Part II.—NATURAL SCIENCE.

No. I—1884

I.—*The Theory of the Winter Rains of Northern India.*—By HENRY F. BLANFORD, F. R. S., *President, Asiatic Society of Bengal, Meteorological Reporter to the Government of India.*

[Received and Read March 5th, 1884.]

(With Plate I.)

It has long been a commonplace of meteorological hand-books, that the winter, or, as it is more frequently (but less accurately) termed, the north-east monsoon, is due to a reversal of those conditions which, in the summer season, set in movement a flow of air from equatorial regions towards the plains of Southern and Eastern Asia. But, beyond this general statement of fact, very little has been done towards working out the physical characteristics of this familiar phenomenon of the Indian winter; and such vague conceptions as are implied in the popular theory, leave entirely unexplained the well-known occurrence of rain, about Christmas time, in Upper India; a region, which, according to that theory, should then be the seat of a barometric maximum, the fount and source of the winter monsoon.

Since the establishment of a Meteorological Department under the Government of India, has rendered it possible to study the weather of India as a whole, from day to day, some insight has been gained into

the phenomena which precede and accompany the cold-weather rainfall of Northern India. In each of the annual reports on the Meteorology of India, in recent years, two or three instances of this cold weather rainfall have been described and illustrated at some length; and at the present time, although many important points still require further elucidation, it is at least possible to set forth some generalizations on the conditions which usher in the precipitation of the cold-weather rains, and on the probable source of the vapour which feeds them.

The four charts on Plate I exhibit the average distribution of atmospheric pressure in the months of November, December, January, and February. These charts, being based on the registers of duly verified barometers during the last seven years, corrected to a common standard and reduced to sea-level values from elevations, determined in all but a few exceptional instances, by actual spirit-levelling to the mean sea-surface, may be accepted as representing, with a near approximation to truth, the relative differences of pressure which characterize the winter months in India.\* Certain characters common to all, may be regarded as distinctive of the season. The seat of highest pressure is in the neighbourhood of Peshawar. Whether this may be taken as indicating that the pressure on the highlands of Cabul is also greater than at similar elevations over the plains of India is, however, very doubtful. The situation of Peshawar on a plain of moderate extent, girt around with mountains, is such that the high pressure may be and very probably is a local effect of the cooled air, draining on all sides from the surrounding slopes and filling the basin from which its escape is much obstructed. A similar high pressure is shown by some other stations near the foot of the N. W. Himalaya, of which Dehra is a notable example. The conditions of pressure at higher elevations over the Himalaya, will be noticed presently.

The next feature to be noticed is that, throughout the winter months, the axis of average high pressure on the plains and plateaux of India, occupies nearly the same situation as that of low pressure at

\* Rigorously speaking any such representation must of course involve an element of unreality, which is the greater, the greater the difference of land levels in the area embraced in the chart; and, where, as in the case of India, large portions of the area differ by 2,000 feet and upwards, this element attains to some importance. Although it may not seriously impair the value of the chart as an illustration of the pressure-differences or potentials which maintain the system of wind-currents, the fact that the lower strata of air, resting on low alluvial plains, have no horizontal extension to the higher plateaux and cannot therefore be directly and immediately influenced by the atmospheric pressure there existing, is one that must be kept in view in discussing the relation of the winds to the pressure-distribution.

the opposite season. It extends from Upper Sind across Rajputana and the Central India plateau to Chutia Nagpur; the pressure along this axis declining, more or less irregularly, from N. W., to S. E. To the north of this ridge, a trough of relatively low pressure on the Gangetic plain separates it from the higher pressure along the foot of the Himalaya, and, in most years, the pressure in the Punjab is somewhat lower than that of Western Rajputana. On the other hand, to the south of this axis, the pressure falls gradually down to Cape Comorin and Travancore; being, however, considerably higher on the east than on the west coast of the peninsula. In fact, the isobars run down the peninsula almost parallel with the west coast. The low pressure area which runs down the west coast of the peninsula is prolonged to the north, up the Gulf of Cambay, producing a northward bend in the isobars of that region very similar to that shewn by them in the summer monsoon, but with reversed gradients.

Hence the cold weather distribution of pressure may be not inaptly described as a reversal of that which characterizes the summer monsoon; but, in the first place, the barometric differences between the extremes, and therefore the gradients effective in producing the monsoon current, are less than half as great, and, in the second place, the axis of high pressure across Northern India lies further south than its opposite in the summer monsoon. It lies well across the middle of the plateau to the south of the Ganges, instead of following the course of the river, or, as not unfrequently happens in the case of the summer trough of depression, somewhat to the north of it. Thus, both in summer and winter, low pressure tends to prevail in some part or other of the Gangetic valley and the Punjab; but in the summer the gradient declines towards the N. W., in the winter, to the S. E.

There is reason to believe that this normal distribution of pressure is restricted to the lower strata of the atmosphere, that is to say, to the stratum less than 7,000 feet in vertical thickness, measured from the sea-level. Thus, for instance, a row of stations on the plains of the Punjab and Ganges, ranging from Peshawar down to Purneah, shews a small, but decided, fall of pressure from N. W. to S. E., when all the mean readings are reduced to their equivalent values at the sea-level. But if the mean pressures of the hill-stations, Murree, Chakrata, and Darjeeling (all of which are between 6,000 and 7,000 feet, or a little over the latter elevation), be reduced to a common level of 7,000 feet, the gradient at that elevation is found to be slightly, but distinctly, reversed; Darjeeling, the easternmost station, shewing the highest pressure.



*Sea-level Equivalents of Atmospheric Pressure on the Punjab and Gangetic Plains.*

|                | November.<br>ins. | December.<br>ins. | January.<br>ins. | February.<br>ins. |
|----------------|-------------------|-------------------|------------------|-------------------|
| Peshawar ..... | 30·098            | 30·174            | 30·161           | 30·115            |
| Lahore .....   | ·023              | ·097              | ·084             | ·029              |
| Delhi .....    | ·017              | ·089              | ·076             | ·020              |
| Lucknow .....  | ·008              | ·078              | ·062             | ·006              |
| Patna.....     | 29·995            | ·066              | ·060             | ·001              |
| Purneah .....  | ·966              | ·028              | ·036             | 29·977            |

*Equivalents at 7,000 feet of Atmospheric Pressure at Stations on the outer Himalaya.*

|                 | November.<br>ins. | December.<br>ins. | January.<br>ins. | February.<br>ins. |
|-----------------|-------------------|-------------------|------------------|-------------------|
| Darjeeling..... | 23·404            | 23·380            | 23·339           | 23·320            |
| Chakrata .....  | ·360              | ·340              | ·305             | ·281              |
| Murree .....    | ·356              | ·332              | ·302             | ·268              |

It was shewn also in a paper on the winds of Northern India,\* and in the *Indian Meteorologists' Vade Mecum*,† that, as between the Himalaya and Ceylon, the plane of neutral pressure, in January and February, is at a lower level than 7,000 feet; but not in the months of November and December; at least as an average condition. To this point, which is important, I shall presently return.

These facts of the pressure-distribution prepare us then to expect that which our wind-registers shew, *viz.*, that the winter monsoon is a much shallower, weaker, and more unsteady current than its correlative of the summer season. On the plains, the air is very calm in the Punjab; and, to the south and south-east, flows as a very gentle current, chiefly a day wind, drifting from the N. W. down the Gangetic plain; from north or N. E., and somewhat stronger, across the Central Indian plateau and the Satpuras; and from north or N. N. W. in Lower Bengal; then turning to N. E. or E. in the northern part of the peninsula, while, down the Bay of Bengal, it is pretty steady as the well-known N. E. monsoon. It turns, therefore, in an anticyclonic curve around the seat of maximum pressure in North Western India. Its rate of movement, its comparative steadiness, and its mean direction may be estimated from the following tables:—

\* Phil. Trans. vol. 164, p. 563.

† Page 175.

1884.]

*Rains of Northern India.*

*Percentage of Wind-directions and Mean Daily Movement of the Wind at  
Stations in Northern India during the Winter Monsoon.  
(November to February.)*

|              |                      | Years.            | Per cent. |    |    |    | Mean daily<br>movement in<br>miles. |    |
|--------------|----------------------|-------------------|-----------|----|----|----|-------------------------------------|----|
|              |                      |                   | N         | E  | E  | N  |                                     |    |
| A            | North-West<br>India. | Rawalpindi ... .. | 12        |    |    |    | 43                                  |    |
|              |                      | Lahore .....      |           |    |    |    | 48                                  |    |
|              |                      | Ludhiana .....    |           |    |    |    | 33                                  |    |
|              |                      | Delhi .....       |           |    |    |    | 73                                  |    |
|              |                      | Mooltan .....     |           |    |    |    | 47                                  |    |
|              |                      | Jacobabad .....   |           |    |    |    | 48                                  |    |
|              |                      | Bickaneer ... .   |           |    |    |    | 68                                  |    |
| B            | Gangetic P           | Roorkee .....     | 17        |    |    | 40 | 50                                  |    |
|              |                      | Barcilly .....    | 12        |    |    | 16 | 68                                  |    |
|              |                      | Lucknow .....     | 12        |    |    | 25 | 43                                  |    |
|              |                      | Allahabad ... ..  | 12        |    |    | 30 | 38                                  |    |
|              |                      | Gorakhpur. ....   | 12        |    |    | 34 | ?                                   |    |
|              |                      | Benares .....     | 16        |    |    | 14 | 64                                  |    |
|              |                      | Patna .....       | 13        |    |    | 19 | 44                                  |    |
| Purneah .. . | 7                    |                   |           |    | 46 |    |                                     |    |
| C            | Eastern<br>India     | Hyderabad .....   | 4         |    |    |    | 158                                 |    |
|              |                      | Kurrachee .....   | 21        | 18 |    |    | 229                                 |    |
|              |                      | Rajkot .....      | 4         |    |    |    | 126                                 |    |
|              |                      | Deesa .....       |           | 23 |    |    | 202                                 |    |
|              |                      | Pachbudra .....   | 3         | 24 |    |    | ?                                   |    |
|              |                      | Surat .....       |           | 17 |    |    | 132                                 |    |
| D            | India P<br>atpura    | Mount Abu .....   |           | 19 | 14 | 18 | 105                                 |    |
|              |                      | Neemuch ..        | 4         | 12 | 12 | 16 | 153                                 |    |
|              |                      | Indore ...        | 4         |    |    | 8  | 59                                  |    |
|              |                      | Jhansi ..         | 10        |    |    |    | 51                                  |    |
|              |                      | Nowgong ..        | 4         | 18 |    |    | 38                                  |    |
|              |                      | Saugor .....      | 11        | 16 | 29 |    | 54                                  |    |
|              |                      | Sutna ...         | 5         | 17 | 13 | 8  | 89                                  |    |
|              |                      | Jubbulpore.       | 11        | 24 | 18 | 7  | 55                                  |    |
|              |                      | Pachmarhi .       | 11        | 15 | 17 | 8  | 68                                  |    |
|              |                      | Seoni ..          | 11        | 40 | 5  |    | 68                                  |    |
| E            | Chutli<br>Nagpu      | Chikalda ..       | 5         | 25 | 4  | 4  | 110                                 |    |
|              |                      | Hazaribagh        | 14        | 10 | 4  | 4  | 23                                  | 40 | 118 |
| F            | Low<br>ing.          | Berhampore .....  | 14        | 8  | 3  | 16 | 25                                  | 41 |
|              |                      | Calcutta ..       |           | 7  | 6  | 15 | 20                                  | 80 |
|              |                      | Jessore ..        |           | 10 | 3  | 8  | 25                                  | 42 |
|              |                      | Dacca ...         |           | 9  | 3  | 15 | 20                                  | 53 |

On comparing these tables with those for the summer monsoon, at the same stations, the relative greater frequency of calms, more especially in the Punjab and the Gangetic plains, the inferior steadiness of the wind in the prevailing quarter, and the very low absolute rate of its movement are strikingly apparent. The highest rates of movement are in Western India, as are also those of the summer winds, but the former vary from less than half to less than two-thirds of the latter, and the directions are much more variable.

It is further to be noticed that, while, at most stations, there is one direction of decided maximum, with some oscillation on either side (this being the local direction of the winter monsoon), at stations in the Punjab and the adjacent parts of the Gangetic plain, and also at Jhansi, Jubbulpore, Chikalda, Mount Abu, and Kurrachee, there is a distinct secondary maximum from an opposite quarter; and, at Mount Abu, Neemuch, and Bickaneer, a certain absolute preponderance of southerly winds. These are the winds which interrupt the winter monsoon and bring up the vapour that is condensed on the Himalaya as snow, and on the plains of Northern India as the winter rains of that region.

In fact, not only is the barometric gradient which characterizes the winter monsoon less highly inclined than that of the opposite season, and the vertical height to which it prevails (the elevation of the neutral plane) considerably less, but it is more frequently reversed, and especially so in January and February; and, as a temporary phenomenon, barometric minima, with the usual vortical systems of winds, occasionally appear in Northern India. On such occasions, rain almost invariably follows, beginning generally over the mountains that hem in the Punjab, and on the plains at their foot, and thence extending to the east and south-east; while the barometric depression moves eastward, and cold westerly winds, bringing fine weather and a wave of high barometric pressure, follow up in the rear.

In the majority of cases the history of which has hitherto been traced out, the barometric minimum first appeared, and was apparently formed in some part of the great north-western plain, most frequently in the Punjab or Upper Sind; but, in some cases, in Western Rajputana. Mr. F. Chambers has put forward the suggestion\* that these minima travel hither from regions further west, from the plateau of Beloochistan or the still loftier mountain-tract of Afghanistan; but this seems to be a misapprehension. We have, indeed, no observatory in Afghanistan, and it may be long before any systematic observation is possible in that interesting, but turbulent, country. But an observatory has existed for some years past at Quetta, and, although its elevation is

\* *Nature*, vol. xxiii, p. 400.

not known with sufficient precision to admit of its barometric register being reduced to terms comparable with those of the Sind and Punjab stations, I have compared the oscillations of the Quetta barometer with those in the valley of the Indus, when barometric minima have appeared in Upper Sind, and find that, with two very doubtful exceptions, in January and February 1880, any fall of pressure at Quetta was either simultaneous with the fall in Sind, or somewhat later. In one of these exceptional instances, there was a slight fall at Quetta two days, and in the other one day, before it took place at Jacobabad; but on both occasions, the great fall, when the minimum was established in Upper Sind, was simultaneous at both stations. In such cases as that of the 25th January 1878 (when the minimum first appeared at Deesa) and those of January, February, and March 1881 (when a barometric depression which had existed in Western Rajputana throughout the cold season, was simply intensified immediately prior to the rainfall), there could be no question of a depression travelling from the westward.

But it is not only in North-Western India even, that barometric minima are occasionally formed in the winter months: in the case of the rain of the 10th to 13th January 1878, it first appeared on the western half of the Deccan plateau; in that of the 10th February 1879, a long trough-shaped depression ran through the heart of India from Belgaum to Lucknow, and, in that of the 15th to 18th February 1880, it was first established in the Central Provinces, whence it was transferred to the Punjab; and the distribution of pressure, in Northern India, became strikingly similar to that which characterizes the rainy season.

There is, then, no reason to doubt that, notwithstanding that Northern India is in general and on an average an area of high pressure in the winter season, relatively to lower latitudes, this condition is by no means constant or lasting. The atmospheric pressure, in extra-tropical India, more frequently than that of the peninsula, occasionally falls below that prevailing over the seas to the south, causing vapour-bearing currents to pour in from that direction; and these currents, in ascending around the seat of minimum pressure, chiefly on the east and north of the minimum, condense that vapour as rain (and on the hills as snow). This is a more or less regularly recurrent feature of the winter season.

Of the conditions which determine the formation of these barometric minima, but little can be positively asserted in the present state of our knowledge. That they do not originate in a local excess of temperature in the lower atmospheric strata, is abundantly apparent; the rise of temperature that, in general, precedes the rainfall, and is accompanied

with a rise in the relative and absolute humidity of the air, is simultaneous with the setting in of the southerly wind; and this change of wind implies a pre-existing reversal of the barometric gradient, which is the phenomenon to be accounted for. The following considerations may, however, be worthy of attention as tending to throw some light into the prevailing obscurity.

It has been shewn above, that, at the very moderate elevation of 7,000 feet over the outer Himalaya, the barometric gradient is on an average slightly, but distinctly, reversed. At greater elevations, it is most probable that the reversal is more decided, for I have shewn elsewhere\* that at Leh (11,500 feet) the pressure in February is at its annual minimum, and the wind-registers of all our hill-stations establish the fact that, throughout the winter months, the prevailing winds are southerly. This preponderance is no doubt, in some measure, perhaps mainly, due to the fact that the observations are those of 10 A. M. and 4 P. M. only; at which hours the diurnal up-draught of the mountain winds, in an otherwise still atmosphere, is fully active. But I have myself witnessed at Darjeeling, in December, the effects of a strong steady current, sweeping overhead from the south-west, clothing the snowpeaks with cloud-banners. This strong southerly wind is, however, exceptional; and is that which precedes rain; and although it is not improbable that, at great elevations, there is a more or less steady flow of air towards Central Asia, to feed the outflow, at low levels, from the anticyclone which, as we know, normally exists in the winter over Northern and Central Asia, there is no reason to question that, up to a considerable elevation over Northern India, the more usual condition is one of comparative stillness or at most of light movement. And, in this state of the atmosphere, even a feeble local action, tending to reduce the density and therefore the pressure, may suffice to set up a centripetal influx of air which may in a short time produce a well-developed barometric minimum. How this may be brought about will be shewn presently.

The southerly surface winds that are invariably the precursors of precipitation, are not merely local; they prevail also far to the south, indeed over a great part of India; and they arrive charged with vapour gathered both from the sea and from the warmer land-surface of more southerly regions.

It seems not improbable, then, that the ulterior conditions which give rise to the winter rains, may have their seat in the more elevated or middle region of the atmosphere; and we must look to the formation of cloud as the condition which, by disturbing the thermal equilibrium

\* *Indian Met. Memoirs*, vol. i, p. 224.

of the atmosphere, determines a convective current with a cyclonic circulation, and a barometric minimum. The prevailing calmness of the Punjab atmosphere, combined with a high degree of relative humidity in the winter months, affords conditions not unfavourable to this action.

Before proceeding further with this discussion, it will be of advantage to consider the distribution of the winter rainfall, its distribution both in time and space.

For this purpose it will not be necessary to illustrate the subject in great detail, and, instead of giving the means of individual stations, I shall summarize the data in the form of the averages of large areas. The following table gives the average amount of the fall in each of the months from November to March.

*Summary of the Winter Rainfall of Extra-tropical India.*

|                                   | Stations. | INCHES OF RAINFALL. |           |          |           |        | Total. |
|-----------------------------------|-----------|---------------------|-----------|----------|-----------|--------|--------|
|                                   |           | November.           | December. | January. | February. | March. |        |
| Peshawar and Derajat.....         | 5         | 0·46                | 0·51      | 0·65     | 1·06      | 1·29   | 3·97   |
| Hzara and Patwar .....            | 4         | 1·06                | 1·50      | 1·57     | 2·64      | 2·66   | 9·43   |
| The four doabs .....              | 11        | 0·18                | 0·60      | 0·77     | 1·15      | 1·14   | 3·84   |
| Eastern Punjab .....              | 11        | 0·07                | 0·58      | 0·91     | 0·95      | 0·95   | 3·46   |
| Kangra, Sirmoor and Kumaon ..     | 11        | 0·18                | 1·01      | 2·10     | 2·80      | 2·54   | 8·63   |
| N. W. P. & Oudh, Western half*... | 24        | 0·06                | 0·33      | 0·81     | 0·66      | 0·57   | 2·43   |
| Ditto ditto, Eastern half ...     | 15        | 0·10                | 0·15      | 0·66     | 0·55      | 0·34   | 1·80   |
| North Behar and Bhagalpore.....   | 5         | 0·08                | 0·10      | 0·58     | 0·53      | 0·45   | 1·74   |
| Northern Bengal .....             | 8         | 0·34                | 0·12      | 0·43     | 0·79      | 1·18   | 2·86   |
| Assam and Cachar .....            | 13        | 0·95                | 0·36      | 0·64     | 1·35      | 3·45   | 7·00   |
| Upper Sind .....                  | 3         | 0·08                | 0·16      | 0·23     | 0·37      | 0·44   | 1·28   |
| Lower Sind, Cutch and Gujarat...  | 18        | 0·08                | 0·07      | 0·11     | 0·16      | 0·06   | 0·48   |
| Rajputana .....                   | 20        | 0·09                | 0·27      | 0·11     | 0·31      | 0·15   | 0·93   |
| Central India, &c. ....           | 24        | 0·16                | 0·19      | 0·42     | 0·40      | 0·23   | 1·40   |
| Mirzapore and Chutia Nagpur ...   | 14        | 0·22                | 0·13      | 0·58     | 0·73      | 0·57   | 2·28   |
| Lower Bengal .....                | 15        | 0·50                | 0·17      | 0·48     | 1·07      | 1·60   | 3·82   |

The above table includes the whole of extra-tropical India, and it is only in a portion of this region that the cold weather rainfall can be regarded as a well-marked and regularly recurrent phenomenon; having a distinct maximum, that is to say, in the winter or spring months and equally defined minima before and after. The variations, shewn in the above table, are considerable, both as regards the total amount and the epoch of the maximum. It is on the N. W. Himalaya

\* The meridian of Lucknow is taken as the boundary.

and on the hills of the Northern Punjab that these rains are most copious, and that the maximum falls latest; the precipitation frequently taking the form of snow at all but the less elevated stations. In the extreme north-west, they attain their maximum in March and April; for the April rainfall (not shewn in the table) is about equal to that of March at Peshawar and in the hills of Hazara, while that of May and June is insignificant. But south of the Salt Range, and on the plains of the Eastern Punjab, the rainfall of February and March exceeds that of April. Still further to the south-east, throughout the greater part of the Gangetic plain, the maximum occurs still earlier, *viz.*, in January; and this holds good as far as Behar and the confines of Northern Bengal. This anticipation of the maximum is not due to the January rainfall of the Gangetic plain being heavier than that of the Punjab. On the contrary, it is rather less: but the decrease in a south and S. E. direction is much less rapid in January than in the subsequent months. In Northern Bengal, even the January maximum has vanished; and while the average rainfall of that month is only slightly less than in Behar and the eastern part of the N. W. Provinces, that of February is higher, and that of March shews a further considerable increase. So far, the course of the variation seems to resemble that of the N. W. Punjab; but the further steady-increase of the fall in April, May, and June shews that this resemblance is fallacious, and that we have here to do with a phenomenon of a different order, *viz.*, the storm precipitation of the spring months, the characteristics of which are still more pronounced in the more easterly province of Assam. As a well-marked feature of the local meteorology, the cold weather rainfall does not extend, in an easterly direction, beyond the province of Behar.

Turning now to the regions somewhat further south, but still, for the most part, without the tropic, we see that in Upper Sind the total fall of the five months is very small, notwithstanding that it represents nearly one-third of that of the year; and also that, as in the Derajat, it reaches its maximum in March. In Lower Sind, Cutch, and Gujarat, the whole precipitation of the season is insignificant; but a maximum is still faintly indicated in February, and the same is more strongly marked in Rajputana, where the fall is about double as great. In Rajputana, it would appear that the December rainfall is almost as great as that of March; but this is mainly due to an exceptionally heavy rainfall in December 1877,\* combined with the fact that the Rajputana registers extend over a shorter period than those of most other parts

\* On this occasion nearly five inches of rain were registered at Banswara, between 3 and 4 inches at Jhalrapatam and Ulwar, and over 2 inches at Kotah, Deoli, and Bhurtpore.

of the country. I do not think, therefore, that, on the average of a long period of years, the November rainfall of Rajputana would be found to follow a different law of distribution from that of other provinces around. In Central India, including those portions of the Central Provinces and the N. W. Provinces that extend between the Jamna and the Satpura range, the total fall is again higher, with a maximum in January and February; and, still further east, in Mirzapore, South Behar, and Chutia Nagpur, it is again greater, with the maximum in February; but this apparent retardation of the maximum is evidently due to the inclusion of the early spring storms which in Chutia Nagpur become of relatively greater importance; and this is rendered further evident in the table for Lower Bengal.

The conditions which determine the storm precipitation of the spring months will be noticed elsewhere. Meanwhile, it results from the above analysis that the cold weather rainfall, as here considered, is that which takes place chiefly on the north and east of the barometric depressions, which are occasionally formed, in the winter months, in North-Western India. It is most copious where normally the winter temperature is lowest, *viz.*, on the N. W. Himalaya. It decreases rapidly to the south, and less rapidly to the south-east, and, in this latter direction, it blends into and becomes with difficulty distinguishable from the rainfall of the spring storms, which are, however, a phenomenon of a different order.

Having thus defined the area and noticed the general characteristics of the winter rainfall of North-Western India, I will return to the question of the origin of those barometric depressions which have been shewn to be the immediate precursors of the precipitation, or perhaps rather of simultaneous formation. The area above defined as that of the winter rains, is identical with that in which, as has long been known, the relative humidity of the air, instead of diminishing towards the interior of the country, increases with the increasing distance from the sea-coast. On page 203 of the *Indian Meteorologist's Vade Mecum* (Part II, para. 109), I described this phenomenon as follows: "In the maritime provinces (of India) there are but one (annual) period of maximum and one of minimum humidity; in the Punjab and in Central India and the North-Western Provinces, there are two annual maxima and two minima; and in the drier part of the first named province, the winter is the dampest season of the year \* \* \* \*. Stations on the coast line have, at all times of the year, a higher degree of relative humidity than those on the plains of the interior. But the rate of increase is very different at different seasons; and in consequence of the greater cold of Upper and extra-tropical India, in the first three months of the



year, the rule of increasing dryness with increasing distance from the coast holds good inland, only as far as Behar; and thence to the Punjab the relative humidity of the atmosphere increases steadily. It appears to be higher also through Central India, north of the Satpuras, but the meteorological statistics of this tract have not yet been sufficiently worked out to enable us to fix the limits of the area of higher winter humidity."

The above passage was written in 1876, only a year after the meteorological data for the whole of India had been, for the first time, concentrated in one central office, and when the system of observation had been but recently extended to many stations in Rajputana and Central India. It is, therefore, desirable to set forth, in a tabular form, some excerpts from the further evidence which has since been put on record; and, to this end, I give, in the following tables, first, the absolute humidity of the air as represented by the proportion of vapour in 1,000 parts (volumes) of air, second, the relative humidity, and, third, the cloud proportion (in thousandths of the sky-expanse\*) in each of the six months November to April for four series of stations, three passing successively from east to west (or north-west) and representing respectively the Himalaya, the alluvial plain, and the plateau which extends between the latter and the Satpura range; and the fourth passing from south to north, beginning with stations south of the Satpura range, and terminating in the Punjab.

\* The figures of the two latter tables are extracted from those of the average values of the several meteorological elements given in the Report on the Meteorology of India in 1881.

*Mean Absolute and Relative Humidity of the Air and Proportion of Cloud in Northern India in the Winter and Spring Months.*

884.

| STATIONS.            | Elevation from |           | Volume of vapour in 1000 of air. |                |               |                |                |                |               |                | Percentage of saturation. |                |               |                | Cloud proportion |        |     |     |     |
|----------------------|----------------|-----------|----------------------------------|----------------|---------------|----------------|----------------|----------------|---------------|----------------|---------------------------|----------------|---------------|----------------|------------------|--------|-----|-----|-----|
|                      | Fe-<br>b.      | ru-<br>a. | Novem-<br>ber.                   | Decem-<br>ber. | Janu-<br>ary. | Febru-<br>ary. | Novem-<br>ber. | Decem-<br>ber. | Janu-<br>ary. | Febru-<br>ary. | Novem-<br>ber.            | Decem-<br>ber. | Janu-<br>ary. | Febru-<br>ary. | March.           | April. |     |     |     |
| Darjeeling, .....    | 6,712          | 375       | 9                                | 9              | 10            | 12             | 15             | 75             | 73            | 78             | 71                        | 439            | 425           | 569            | 592              | 531    | 614 |     |     |
| Ranikhet, .....      | 6,069          | 730       | 8                                | 8              | 8             | 10             | 11             | 58             | 56            | 60             | 55                        | 122            | 270           | 344            | 461              | 378    | 335 |     |     |
| Chakrata, .....      | 7,050          | 750       | 6                                | 6              | 7             | 8              | 10             | 58             | 52            | 58             | 54                        | 153            | 351           | 413            | 539              | 465    | 385 |     |     |
| Muree, .....         | 6,344          | 750       | 6                                | 5              | 6             | 8              | 10             | 43             | 49            | 57             | 51                        | 315            | 455           | 516            | 541              | 595    | 520 |     |     |
| Sangor Island, ..... | 6              | 22        | 17                               | 18             | 27            | 32             | 73             | 75             | 77            | 78             | 80                        | 248            | 180           | 180            | 188              | 356    | 474 |     |     |
| Calcutta, .....      | 18             | 65        | 20                               | 15             | 14            | 22             | 28             | 71             | 70            | 69             | 69                        | 73             | 220           | 196            | 127              | 192    | 225 | 265 |     |
| Jessore, .....       | 33             | 95        | 20                               | 16             | 14            | 21             | 27             | 68             | 63            | 60             | 55                        | 55             | 62            | 210            | 132              | 158    | 176 | 274 | 336 |
| Berhampore, .....    | 66             | 176       | 18                               | 14             | 12            | 18             | 22             | 69             | 65            | 58             | 62                        | 257            | 194           | 215            | 192              | 291    | 320 |     |     |
| Purneah, .....       | 125            | 295       | 17                               | 14             | 12            | 16             | 21             | 66             | 59            | 55             | 56                        | 93             | 107           | 122            | 113              | 140    | 150 |     |     |
| Patna, .....         | 179            | 307       | 15                               |                |               | 14             | 16             | 60             | 55            | 43             | 39                        | 176            | 201           | 249            | 275              | 315    | 233 |     |     |
| Benares, .....       | 267            | 368       | 13                               |                |               | 12             | 13             | 63             | 57            | 43             | 36                        | 120            | 162           | 222            | 240              | 217    | 184 |     |     |
| Allahabad, .....     | 307            | 430       | 14                               |                |               | 13             | 15             | 67             | 60            | 46             | 36                        | 92             | 163           | 193            | 222              | 189    | 143 |     |     |
| Lucknow, .....       | 369            | 550       | 12                               |                | 11            | 14             |                | 59             | 55            | 46             | 37                        | 91             | 192           | 282            | 333              | 291    | 222 |     |     |
| Bareilly, .....      | 568            | 665       | 13                               |                |               |                |                | 64             | 61            | 53             | 41                        | 67             | 177           | 271            | 309              | 261    | 177 |     |     |
| Roorkee, .....       | 887            | 690       | 12                               |                |               |                |                | 65             | 62            | 52             | 36                        | 87             | 222           | 285            | 358              | 264    | 227 |     |     |
| Ludhiana, .....      | 812            | 690       | 10                               | 9              |               |                |                | 63             | 63            | 57             | 50                        | 155            | 249           | 333            | 389              | 386    | 264 |     |     |
| Sialkot, .....       | 829            | 717       | 11                               | 10             | 10            |                |                | 68             | 67            | 58             | 42                        | 214            | 309           | 404            | 443              | 448    | 367 |     |     |
| Rawalpindi, .....    | 1,652          | 730       | 10                               | 9              | 8             |                |                | 67             | 68            | 63             | 59                        | 199            | 305           | 388            | 442              | 439    |     |     |     |

*Mean Absolute and Relative Humidity of the Air and Proportion of Cloud in Northern India in the Winter and Spring Months (Continued).*

| STATIONS.         | Elevation in feet. | Miles from Sea. | Volume of vapour in 1000 of air. |           |          |           |        | Percentage of saturation. |           |           |          |           | Cloud proportion $\frac{2}{1000}$ . |        |           |           |          | H. F. B. | Ford. | The | of | Winter |           |        |        |
|-------------------|--------------------|-----------------|----------------------------------|-----------|----------|-----------|--------|---------------------------|-----------|-----------|----------|-----------|-------------------------------------|--------|-----------|-----------|----------|----------|-------|-----|----|--------|-----------|--------|--------|
|                   |                    |                 | November.                        | December. | January. | February. | March. | April.                    | November. | December. | January. | February. | March.                              | April. | November. | December. | January. |          |       |     |    |        | February. | March. | April. |
| Hazaribagh, ..... | 2,010              | 205             | 12                               | 10        | 9        | 10        | 10     | 12                        | 53        | 52        | 51       | 44        | 36                                  | 32     | 203       | 192       | 236      | 211      | 258   | 262 |    |        |           |        |        |
| Sutna, .....      | 1,040              | 450             | 10                               | 8         | 8        | 9         | 8      | 10                        | 42        | 48        | 47       | 41        | 29                                  | 25     | 137       | 162       | 216      | 292      | 262   | 252 |    |        |           |        |        |
| Jhansi, .....     | 855                | 490             | 10                               | 9         | 9        | 10        | 11     | 12                        | 39        | 45        | 47       | 42        | 34                                  | 28     | 20*       | 38*       | 66*      | 75*      | 40*   | 46* |    |        |           |        |        |
| Neemuch, .....    | 1,639              | 280             | 9                                | 7         | 7        | 8         | 9      | 11                        | 35        | 38        | 35       | 35        | 30                                  | 26     | 63        | 149       | 151      | 310      | 234   | 230 |    |        |           |        |        |
| Ajmere, .....     | 1,611              | 410             | 11                               | 9         | 9        | 10        | 12     | 15                        | 45        | 49        | 47       | 46        | 42                                  | 38     | 101       | 152       | 245      | 273      | 280   | 249 |    |        |           |        |        |
| Raipur, .....     | 960                | 270             | 16                               | 12        | 12       | 14        | 13     | 15                        | 60        | 56        | 55       | 51        | 41                                  | 36     | 168       | 127       | 132      | 112      | 165   | 209 |    |        |           |        |        |
| Nagpur, .....     | 1,025              | 350             | 14                               | 12        | 11       | 12        | 11     | 13                        | 52        | 50        | 49       | 42        | 32                                  | 28     | 257       | 238       | 233      | 194      | 255   | 305 |    |        |           |        |        |
| Akola, .....      | 930                | 270             | 13                               | 11        | 10       | 10        | 11     | 10                        | 50        | 48        | 44       | 37        | 28                                  | 22     | 134       | 146       | 139      | 199      | 127   | 128 |    |        |           |        |        |
| Jubbulpore, ..... | 1,351              | 420             | 13                               | 10        | 11       | 12        | 13     | 13                        | 57        | 56        | 58       | 53        | 40                                  | 32     | 171       | 197       | 218      | 238      | 246   | 217 |    |        |           |        |        |
| Satna, .....      | 1,040              | 450             | 10                               | 8         | 8        | 9         | 8      | 10                        | 42        | 48        | 47       | 41        | 29                                  | 25     | 137       | 162       | 216      | 292      | 262   | 252 |    |        |           |        |        |
| Nowgong, .....    | 757                | 515             | 11                               | 10        | 9        | 10        | 11     | 14                        | 50        | 56        | 52       | 48        | 37                                  | 31     | 91        | 153       | 182      | 365      | 240   | 205 |    |        |           |        |        |
| Jhansi, .....     | 855                | 490             | 10                               | 9         | 9        | 10        | 11     | 12                        | 39        | 45        | 47       | 42        | 34                                  | 28     | 20*       | 38*       | 66*      | 75*      | 40*   | 46* |    |        |           |        |        |
| Agra, .....       | 555                | 540             | 11                               | 9         | 9        | 10        | 11     | 13                        | 43        | 53        | 55       | 49        | 40                                  | 31     | 54        | 131       | 167      | 245      | 175   | 144 |    |        |           |        |        |
| Delhi, .....      | 718                | 615             | 11                               | 9         | 9        | 10        | 12     | 13                        | 46        | 53        | 55       | 52        | 45                                  | 34     | 80        | 176       | 309      | 334      | 299   | 269 |    |        |           |        |        |
| Ludhiana, .....   | 812                | 690             | 10                               | 9         | 9        | 11        | 12     | 15                        | 51        | 62        | 63       | 63        | 57                                  | 50     | 155       | 249       | 333      | 389      | 386   | 264 |    |        |           |        |        |

The estimates of cloud proportion are probably affected by a large personal equation.

The above table confirms and justifies the description already quoted from the *Vade Mecum*, and also the generalization just given, that the area of the winter secondary rainfall maximum coincides with that in which there is also a winter secondary maximum of relative humidity. But it also brings into prominence some further facts, which assist in throwing much light on the causes of the rainfall. In the first place, it is to be noticed that the increase of the relative humidity of the later months, as we proceed from Behar towards the Punjab, is due, solely, to the fall of temperature; the absolute humidity being almost constant; but the latter is decidedly lower on the high ground of Central India and Rajputana, south of the Gangetic plain, than on the latter and in the Punjab. These two facts, *viz.*, the uniformity of the absolute humidity over the riverain tract, and its decrease on the higher ground to the south, indicate that it is mainly dependant on local evaporation; being, in fact, furnished by the rivers, the undried swamps left by the autumnal floods, and, in no small degree, probably, by irrigation and the rich vegetation of the green winter crops. In the second place, it is to be observed that this riverain tract also coincides with the region of lower normal pressure, to the north of the axis of maximum pressure, shewn on the normal baric charts, on Plate II. And lastly, the tendency to cloud formation follows, on the whole, the same laws of distribution as the relative humidity of the lower atmosphere, with, however, this important exception; that, except in April and to a slight extent in March, it is lower in the neighbourhood of the coast (in Lower Bengal), notwithstanding the higher relative humidity of the lower atmosphere, than in the Upper Provinces, where the rainfall generally originates.

Now putting together the several facts thus independently elicited from the study of our registers, we arrive, I think, at the outlines of a consistent theory of the production of the winter rainfall. We have, in the first instance, steady evaporation over an extensive moderately humid tract, at a comparatively low temperature, it is true, but in an atmosphere, the stillness of which allows of steady diffusion of the vapour to high levels, and the consequent formation of cloud. The slight disturbance of the baric equilibrium which follows (since the vertical decrease of temperature in a cloud-laden atmosphere is slower than in a clear atmosphere), is succeeded by a gentle indraught of warmer and more humid air from the south; for the Himalaya bars access to northerly winds. A vortex is then rapidly formed, accompanied with an increased cloud-formation, and speedily followed by precipitation; which takes the form of snow on the hills, and of rain over the river plains. The rainfall is invariably followed by a cool wind, and a wave of high barometric pressure from the west, which I can only

attribute to a drainage of cool heavy air from the valleys of the hills surrounding the Punjab and the high lands of Beloochistan and Afghanistan; air cooled by the precipitation on the mountains.

If the above view be true, the stillness of the atmosphere, combined with the presence of a moderate evaporation, must be accepted as the condition which primarily determines the formation of barometric minima and the winter rains of Northern India. And this stillness is obviously due to the existence of the lofty mountain ranges which surround Northern India, leaving free access to the plains open only to the south.

Were the Himalayan chain absent and replaced by an unbroken plain, stretching up to the Gobi desert, it is probable that the winter rains of Northern India would cease; any local evaporation in the Punjab and Gangetic valley would be swept away by strong dry N. E. winds blowing from the seat of high pressure, which, in the winter months, lies in Central Asia; and instead of the mild weather and gentle breezes which now prevail at that season, on the Arabian Sea, it would be the theatre of a boisterous and even stormy monsoon, such as is its local equivalent of the China Seas. Other and even greater changes of climate, that would supervene on the suppression of the Himalayan range and the consequent alteration of the summer monsoon, its precipitation, and the course of the land drainage thereby fed, it would be beyond the province of my present subject to discuss.

II.—*Descriptions of some new Asiatic Diurnal Lepidoptera; chiefly from specimens contained in the Indian Museum, Calcutta.*—By FREDERIC MOORE, F. Z. S., A. L. S. Communicated by the NATURAL HISTORY SECRETARY.

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Family NYMPHALIDÆ.

Subfamily SATYRINÆ.

Genus YPITHIMA, Hübner.

YPITHIMA MAHRATTA, n. sp.

Male and female. Upperside brown; forewing with a subapical bipupilled ocellus; between which and the outer margin is a pale brown curved fascia as in *Y. newara*: hindwing with a very small subanal unipupilled ocellus.

Underside pale whitish-brown, very numerous covered with short delicate pale brown strigæ, which are uniformly disposed: forewing with

a brownish marginal fascia, which curves below the ocellus and extends up the disc towards the costa: hindwing with a very small apical ocellus, and two anal ocelli of the same size.

Expanse  $1\frac{1}{10}$  to  $1\frac{4}{10}$  inch.

HAB. Deccan (*Dr. Day*). In coll. F. Moore.

Allied to *Y. ariaspa*, *Y. ruru*, and to *Y. norma*. Nearest to *Y. norma*, the type specimens of which are from China. Differs from the last species, on the upperside, in having a smaller ocellus on the forewing, and a single subanal ocellus on the hindwing. Underside with shorter and more numerous strigæ; both the apical and the two anal ocelli of hindwing are half the size of those in *Y. norma*.

The hindwing also has a comparatively longer costal margin, which thus gives the apex and exterior margin less convexity.

YPTHEMA APICALIS, n. sp.

Male. Upperside pale brown: forewing with a small rounded bipupilled apical ocellus, above which is a distinct broad whitish streak: hindwing with two very small subanal ocelli, the upper one minute, the anal and apical ocellus of the underside being slightly visible from above; across the middle of the lower discal area is a faint pale slight fascia. Underside pale brownish-ochraceous, with indistinct darker brown uniformly disposed strigæ: forewing with the apical ocellus and white upper streak as above: hindwing with a small apical and three lower ocelli, the anal one bipupilled; an indistinct pale whitish fascia is traceable across the disc above the lower ocelli.

Expanse  $1\frac{3}{8}$  inch.

HAB. Deyra Dhoon (*Godwin-Austen*). In coll. F. Moore.

YPTHEMA KASMIRA, n. sp.

Male and female. Upperside dark brown: forewing with a moderately small bipupilled apical ocellus: hindwing with two small subanal ocelli in male and, in female, a third minute anal ocellus.

Underside purpurascens brownish-white, densely covered with uniformly disposed purplish-brown strigæ: forewing with prominent apical ocellus: hindwing with prominent large apical and three lower ocelli, the anal one tripupilled.

Expanse ♂  $1\frac{3}{8}$ , ♀  $1\frac{1}{8}$  inch.

HAB. Cashmere (*Capt. Hellard*). In coll. F. Moore.

YPTHEMA HOWRA, n. sp.

Male and female. Upperside brown: forewing with a bipupilled apical ocellus: hindwing with two small subanal ocelli, some specimens

of both sexes also having a smaller anal ocellus, all with a single pupil. Underside yellowish ochrey-white: forewing with the ocellus as above: hindwing with a very small apical ocellus and four lower ocelli, the two anal being geminated and the smallest. Both wings are crossed by ochreous-brown strigæ; with the three outer transverse fasciæ on forewing, and an angulated discal fascia, as well as a sinuous marginal fascia, on the hindwing.

Expanse ♂  $1\frac{3}{4}$ , ♀  $1\frac{3}{8}$  inch.

HAB. Calcutta. In coll. Ind. Mus., Calcutta, and F. Moore.

Nearest to *Y. hübnéri*. Distinguishable from typical specimens (figured as *Y. philomela*, Hubner, Zutr. fig. 83-84), on the underside, by the yellowish ochreous-white ground-colour, and the transverse fasciæ on the hindwing, as well as by the small size of the ocelli.

#### YPTIIMA HORSFIELDII, n. sp.

Male. Upperside dark olive-brown; discal area dusky; subapical ocellus oval, bipupilled: hindwing with two medial and a minute anal ocellus.

Female. Upperside: forewing with a large rounded ocellus: hindwing with two larger medial, a small anal, and a medium-sized apical ocellus. Underside of male and female ochreous-white: forewing almost covered with dark vinous-brown confluent strigæ: hindwing very sparsely covered with slender brown strigæ very similarly disposed to those in the typical Javan *Y. pandorus*: ocellus of forewing as above: hindwing with two small apical, two larger medial, and two smaller anal ocelli.

Expanse ♂  $1\frac{4}{10}$ , ♀  $1\frac{6}{10}$  inch.

HAB. Java. In coll. F. Moore.

#### Subfamily NYMPHALINÆ.

#### Genus EUTHALIA, Hübner.

#### EUTHALIA ANDERSONII, n. sp.

Male and female. Upperside dark umber-brown, palest in the female; both wings with a marginal bluish-grey band, which extends very narrowly from the apex of forewing and widens across the hindwing to broadly above anal angle. Within and beneath the cells the black streaks are most distinct in the female; across the discal area are two indistinct dusky sinuous fasciæ widening from the costa of forewing, at which end the interspace is slightly paler in the male and distinctly paler in the female. Cilia white.

Underside ochreous-brown in male and yellowish ochreous in female; the outer borders broadly suffused with purplish lilacine-white; cell-marks distinct; across the disc of both wings are two dusky lunular fasciæ with pale interspace, most distinct in the female, the fasciæ being disposed across the middle of the disc.

Expanse ♂  $2\frac{1}{4}$ , ♀  $2\frac{3}{4}$  inches.

HAB. Mergui; Tavoy. In coll. Ind. Mus., Calcutta, and F. Moore.

Nearest allied to *E. cocytus*, Fab.; also to *E. lepidea*, Butler, and to *E. macnairii*, Distant.

Genus CIRRHOCYROA, Doubleday.

CIRRHOCYROA ABNORMIS, n. sp.

Male. Upperside ferruginous-yellow: forewing with a medial discal transverse black lunular waved band, which is broadest at the costal end, a narrower submarginal sinuous band, and a nearly straight marginal line, the interspace from the submarginal band and edge of the wing being suffused with black towards the apex; an indistinct dusky streak at end of the cell: hindwing with a medial discal transverse angulated black lunular band, which is broadest at the costal end; a submarginal lunular line, and a slender nearly straight marginal line; a row of minute black discal dots. Underside brownish-ochreous; a transverse medial slightly purpurascens band, with waved suffused dusky lunular inner border and slender almost straight outer border, the band being quite narrow where it crosses from fore to hindwing and broadly dilated at the costal end on forewing and at anal end on the hindwing; contiguous to the inner border of the band is a similar dusky suffused lunular fascia, the interspace being of a slightly pale yellowish colour; at end of each cell is a dusky double lunular mark, a similar double lunular waved line also extends from middle of the cell on forewing to below the cell on the hindwing; outer border of both wings traversed by faint traces of a yellowish submarginal lunular band; on the forewing is a conspicuous and whitish apical patch, and on the hindwing is a row of very small blackish transverse discal dots.

Expanse  $2\frac{5}{8}$  inches.

HAB. Darjiling. In coll. F. Moore.

Genus ERGOLIS, Boisd.

ERGOLIS TAPESTRINA, n. sp.

Male and female. Comparatively smaller than *E. merione*; outline of forewing more irregular. Upperside paler; with similar transverse sinuous lines on both wings, the two medial lines being somewhat nearer



together, the discal cordate marks having their outline of a uniform width, and being somewhat narrower transversely, thus leaving a slightly but perceptibly wider space between the contiguous lines; the interspaces between the basal lines, the subbasal and medial lines, the discal cordiform marks, and the marginal line and outer margin, are of a more dusky colour, and thus give the wings the appearance of being marked with alternately pale and dusky transverse bands. Underside also paler than in *E. merione*, with more regularly alternate pale and dark transverse bands.

Expanse  $1\frac{5}{8}$  to  $2\frac{1}{2}$  inches.

HAB. N. W. India (Manpuri; Deyra Doon). In coll. F. Moore.

ERGOLIS INDICA, n. sp.

Differs from typical Javanese specimens of *E. ariadne* in its smaller size. Upperside of a duller colour, the markings more obscure and comparatively less sinuous. Underside with paler interspaces between the bands, the apical border of forewing and the marginal border of hindwing greyer, and comparatively broader.

Expanse  $1\frac{5}{8}$  to  $1\frac{9}{16}$  inch.

HAB. Madras; Nilgiris; Bombay; Calcutta. In coll. F. Moore.

#### Family LYCÆNIDÆ.

Genus PARAPITHECOPS, Distant.

PARAPITHECOPS GAURA, n. sp.

Male and female. Upperside brown: forewing with a large white medial longitudinally oval spot, occupying the centre of the wing from middle of the disc to near the base; a small brown dentate spot at upper end of the cell: hindwing with the apical and upper discal area broadly white and traversed by pale brown veins; a slender brown submarginal line enclosing a marginal row of brown spots. Cilia of forewing whitish posteriorly, of hindwing entirely white. Underside greyish white: forewing with a submarginal line composed of slender waved brown lunules, and a marginal line enclosing a row of small linear spots; a slender indistinct brown streak at end of the cell, and three or four dots along the costal edge: hindwing with an irregular submarginal row of brown lunules, a marginal line enclosing a row of darker spots; a black spot at upper end of submarginal line, and a subbasal row of three smaller more or less distinct black spots; a slender brown streak at end of the cell. Antennæ black, ringed with white; pale white beneath, third joint and tip of second black; legs white, banded with black.

Expanse ♂  $\frac{8}{10}$ , ♀  $1\frac{1}{12}$  inch.

HAB. Calcutta. Assam. In coll. Ind. Mus., Calcutta, and F. Moore.

## Genus MEGISBA, Moore.

## MEGISBA SIKKIMA, n. sp.

Male. Differs from *M. thwaitesii*, on the upperside, in being of a darker violet-brown, and in the absence of the short oblique posterior white band on the forewing. Underside, similarly marked to *M. thwaitesii*, except that on the forewing the black spot in middle of the cell is very minute, and there is a spot below the end of the cell between the middle and lower median veins in addition to the two dots, which are here placed beneath the lower median vein, whereas in *M. thwaitesii* the two latter dots, when present, are situated between the middle and lower medians. On the hindwing the three transverse subbasal black spots are comparatively larger, the upper one with two contiguous black dots in front; the cell-spot is prolonged upward to the costal vein and also has some black dots below it, the apical black spot is of an elongated form, and the discal macular band is composed of broader quadrate spots.

Expanse  $\frac{7}{8}$  inch.

HAB. Sikkim. In coll. Indian Museum, Calcutta.

## PATHALIA, n. g.

Closely allied to *Megisba*: forewing comparatively longer, and less regularly triangular in form: hindwing somewhat narrower, and with a slender tail at end of lower median vein. Venation similar. Second joint of palpi shorter, the third joint longer and more slender.

Type, *P. albidisca*.

## PATHALIA ALBIDISCA, n. sp.

Male and female. Upperside dark violet-brown: forewing with a broad medial conical white patch, which extends obliquely from middle of the disc to posterior margin: hindwing with a broad white band crossing from the costal edge to near middle of the abdominal margin; an indistinct marginal row of pale-bordered brown spots. Underside greyish-white: forewing with some black spots along the costal edge, a brown streak at end of the cell, a discal transverse row of short oblique slender interrupted lunules, a submarginal sinuous line enclosing a marginal row of indistinct spots: hindwing with a similar brown cell-streak, a discal zigzag series of broader lunules, a sinuous submarginal line enclosing the marginal row of spots, of which the penultimate is large and black; three equidistant subbasal black spots, a black spot on the abdominal margin above the lower subbasal, and a larger black spot at the apex; tail in both sexes black, tipped with white. Cilia edged with

white. Body above black, antennæ black annulated with white; palpi white, tip black; legs white with black bands.

Expanse ♂  $1\frac{1}{2}$ , ♀  $1\frac{1}{2}$  inches.

HAB. Chittagong; Kurdah, Orissa; N. W. Himalaya (*Capt. Beckett*). In coll. Indian Museum, Calcutta, and F. Moore.

• PATHALIA MALAYA.

*Lycerna malaya*, Horsfield, Catal. Lep Mus. E. I. C. p. 70 (1828), ♀.

• HAB. Java. (*Horsfield collection*.)

Genus LOGANIA, Distant.

LOGANIA SUBSTRIGOSA, n. sp.

Upperside dark violet-brown. Cilia white between the veins. Costal edge of forewing with a minute white dot at end of the veins. Underside purplish white, crossed by a few ochreous-brown short strigæ, and with a thicker streak across middle and end of the cell, and in a zigzag submarginal series; also a marginal series of black spots on the forewing, and a lunular streak on hindwing; a black costal spot also on the hindwing; and the outer marginal border of both wings is ochreous-brown. Body, antennæ, and legs above brown; palpi, legs, and abdomen beneath white.

Expanse  $\frac{9}{10}$  inch.

HAB. Mergui. In coll. Indian Museum, Calcutta.

LOGANIA MARMORATA, n. sp.

Upperside pale purplish violet-brown: forewing with the basal half, curving obliquely from middle of the costa to posterior margin near the angle, violaceous-white: hindwing with the lower basal and discal area also violaceous-white: the traversing veins on both wings being pale violet-brown. Cilia violet-brown. Underside densely mottled with purplish violet-brown and violet-white, interspersed with black speckles, which are most prominent in a lunular marginal fascia; a white spot at end of the cells. Body, antennæ, and legs violet-brown.

Expanse  $\frac{8}{10}$  inch.

HAB. Mergui. In coll. Indian Museum, Calcutta.

LOGANIA ANDERSONII, n. sp.

Female. Upperside pale violet-brown: forewing with a broad longitudinal medial lilacine-grey band of a somewhat triangular form, disposed below the cell, the exterior border of the band being scalloped: hindwing with a narrow medial discal similar-coloured band. Cilia

alternated with white. Underside purplish lilacine-white; both wings with a blackish zigzag cell streak, a transverse discal zigzag duplex line, and two narrow similar submarginal lines, a slender marginal line, and a waved interciliary line.

Expanse  $1\frac{1}{10}$  inch.

HAB. Mergui. In coll. Indian Museum, Calcutta.

Genus *LYCÆNESTHES*, Moore.

*LYCÆNESTHES ORISSICA*, n. sp.

Male. Smaller than *L. lycænina* and *L. lycambes*. Upperside of a similar purpurascient blue. Underside pale purpurascient greyish-brown. Both wings with similar, but more regularly disposed, markings. On the hindwing the subbasal costal black spot is prominent, but the subbasal black spot—so conspicuous in the above species—is absent, the entire exterior margin being uniformly marked.

Expanse  $\frac{9}{10}$  inch.

HAB. Orissa. In coll. Indian Museum, Calcutta, and F. Moore.

*LYCÆNESTHES MERGUIANA*, n. sp.

Male. Upperside violet-blue: hindwing with two indistinct small anal blackish spots and a larger subanal spot. Underside dull greyish-brown; forewing with a transverse antemedial pale-bordered band, a short band at end of the cell, and a broken discal band, two submarginal pale lunular lines: hindwing with a pale-bordered subbasal band, one at end of the cell, and a broken curved discal band; two submarginal pale sinuous lines enclosing a small anal and a large oval subanal black spot, both surmounted by a yellow lunule and speckled with a few metallic-blue scales.

Expanse  $\frac{9}{10}$  inch.

HAB. Mergui. In coll. Indian Museum, Calcutta, and F. Moore.

A much smaller species than *L. bengalensis*. Distinguished from it, on the underside, in the forewing having the antemedial pale-bordered band, and in the hindwing in the more irregular and zigzag pale bands, and the large subanal spot. It is also distinct from *L. lycæna*.

Genus *LYCÆNA*, Fabr.

*LYCÆNA CHAMANICA*, n. sp.

Female. Upperside lavender-blue; extreme outer margin of forewing pale dusky-brown: hindwing with pale dusky-brown costal and

marginal border, the latter traversed by an outer row of whitish lunules. Cilia dusky-brown, edged with white. Underside lilacine ochreous-grey: forewing with a large white-bordered black lunule at end of the cell, a discal transverse row of six spots, and a marginal row of white-bordered dark brown spots, the transverse interspace between the discal and marginal spots also dark brown: hindwing with three straightly disposed transverse subbasal white-bordered black spots, a lunule at end of the cell, and a curved discal interrupted row of eight spots; a marginal row of rounded dark brown spots bordered by an inner dark brown lunular line; the anal and penultimate spot is black, speckled with metallic-blue scales, and surmounted by orange-yellow.

c. Expanse 1 inch.

HAB. Chaman, S. Beluchistan (April). In coll. Ind. Mus., Calcutta.

This species is quite distinct from *L. bracteala*, Butler.

LYCÆNA NADIRA, n. sp.

Female. Upperside dark olivaceous violet-brown: hindwing with a very faint trace of paler marginal lunules. Cilia brown, edged with white. Underside pale olivaceous-ochreous: forewing with an olivaceous white-bordered large black linear spot at end of the cell, and a recurved transverse discal row of six spots, a submarginal row of small blackish dentate spots, and a marginal row of linear spots: hindwing with three subbasal olivaceous white-bordered black spots, a lunule at end of the cell, a curved discal row of eight spots, a submarginal row of small blackish dentate spots, and a marginal row of short linear spots.

Expanse 1 inch.

HAB. Kabul. In coll. Indian Museum, Calcutta.

Quite distinct from *L. fugitiva*, Butler.

LYCÆNA BILUCHA, n. sp.

Male. Upperside brilliant, glossy, opalised, lilacine cobalt-blue, the exterior margin with a very slender black border. Cilia brown, with a broad white edge. Underside pale lilacine ochreous-grey, the base of both wings slightly metallic-green: forewing with a small round white-bordered black spot in middle of the cell, a prominent streak at end of the cell, a transverse discal row of seven spots, and a marginal double row of pale brown white-bordered lunules: hindwing with a prominent white-bordered black spot in middle of the cell, one above it, a less distinct spot below it, and a narrow spot on abdominal margin, a streak at end of the cell, and a discal curved interrupted row of eight spots; a

marginal row of white-bordered narrow black spots, each surmounted by a black-lined reddish lunule.

Expanse  $1\frac{2}{10}$  inch.

HAB. Chaman, S. Beluchistan (April). In coll. Ind. Mus., Calcutta.

Genus CHRYSOPHANUS, Hübner.

CHRYSOPHANUS BARALACHA, n. sp.

Female. Differs from specimens of same sex of *C. phloas* (var. *stygianus*) taken in the neighbouring country of Lahoul. Upperside: forewing golden-yellow, with a blackish quadrate spot in the middle of the cell, a larger spot at its end, three oblique subapical spots, and three lower discal spots, the lowest spot being the longest and curved; from the three subapical spots some black speckles proceed to the discocellular spot; the costal edge is very narrowly bordered with brown, and the exterior margin has a narrow macular brown border of half the width of that of the above-mentioned species: hindwing golden greyish-brown, with a broad pale red outer marginal band, which is very slightly indented with black at end of the veins on its outer border, and on the inner border by a row of indistinct blackish spots surmounted by blue-grey scales, above which is a discal row of five or six smaller black spots and also a black lunule at end of the cell. Underside of similar colour to that of above species: forewing with the spots as on upperside, but pale-bordered, and also a spot at base of the cell, two small spots on the costa above the discal series, and three linear spots on exterior margin above the angle, these latter spots being near the margin: hindwing with less defined red-streaked marginal band, the discal and other spots also comparatively larger.

Expanse  $1\frac{3}{8}$  inch.

HAB. Baralacha Pass (16060 feet), Ladak. Taken in July 1879 by Mr. L. de Nicéville. In coll. Indian Museum, Calcutta.

Genus APHNEUS, Hübner.

APHNEUS TIGRINUS, n. sp.

Differs from typical *A. vulcanus* on the upperside of the forewing in the more prominent red bands, which, in the female, are conspicuously broader; there is also a slender marginal band, more or less indistinct in the male, but very distinct in the female; on the hindwing is a red marginal band extending from above the anal lobe partly up the exterior margin, this band in the female being curved and reaching the subcostal

vein. On the underside the bands are similar, but of a brighter red and with more clearly defined black borders.

Expanse 1 to  $1\frac{1}{2}$  inch.

HAB. Lower Bengal, Calcutta, Maunbhoom, Orissa. In coll. F. Moore and Indian Museum, Calcutta.

APHNÆUS PEGUANUS, n. sp.

Male. Comparatively larger than *A. lohita*. Upperside similarly coloured, anal area dull red, the large black lobe-spot replaced by a few interciliary black and silver scales. Underside very pale reddish-ochreous; the bands dark red, somewhat narrower than in *A. lohita*: forewing with the streak at base longitudinal, narrow, and not extending above the costal vein; the short transverse broad end crossing the cell in *A. lohita* is here absent, the band crossing the middle of the cell is also shorter, the oblique discal and submarginal bands quite confluent at their posterior end, the inner costal band beyond the cell is short, and the next band is the longest, both being widely separated—whereas in *A. lohita* the inner band is the longest and the two are joined externally in the middle, the submarginal band is narrower, and the marginal band very slender: hindwing with the subbasal band composed of three well separated portions; anal lobe red, with a small interciliary black-speckled streak; the submarginal and marginal band narrower, the latter being interrupted in crossing the veins.

Expanse  $1\frac{1}{10}$  to  $1\frac{1}{10}$  inch.

HAB. Magaree, Pegu. In coll. F. Moore.

APHNÆUS HIMALAYANUS, n. sp.

Allied to *A. lohita*. Male and female much larger than typical Javanese specimens. Upperside similarly coloured; anal area duller red. Underside pale creamy-yellow; the bands similar, but of a darker purple-red, all comparatively broader, the marginal band conspicuously broader.

Expanse ♂  $1\frac{3}{10}$ , ♀  $1\frac{4}{10}$  to  $1\frac{7}{10}$  inch.

HAB. Nepal (*Ramsay*), Darjiling (*Elliot*.) In coll. F. Moore.

APHNÆUS KHURDANUS, n. sp.

Male. Upperside dark brown; base of forewing, and hindwing dark slaty-blue; anal lobe red, spots black. Underside dull pale purplish brownish-ochreous; markings very similar to those on underside of same sex of *A. trifurcatus*, but comparatively narrower and more regular in outline.

Expanse 1 to  $1\frac{1}{10}$  inch.

HAB. Khurda, Orissa; Calcutta. In coll. Ind. Museum, Calcutta.

This species belongs to the *lohita*-group of *Aphnæus*. On the underside the markings are extremely like those in *A. trifurcatus*, but the upperside of the forewings has no red patch, as in *A. trifurcatus*. The colour of the upperside is also of a much darker tint; and the outline of the forewing is comparatively more triangular.

*APHNÆUS ORISSANUS*, n. sp.

**Male.** Forewing broader and less regularly triangular than in *A. khurdanus*; hindwing also less produced anally, and the exterior margin convex. Upperside dark brown; base of forewing, and hindwing, slaty-blue; anal lobe red, spots black. Underside pale ochreous-yellow; bands purple-red, similar to those in *A. peguanus*, with the marginal black black-streaked.

Expanse  $1\frac{1}{10}$  inch.

**HAB.** Sonakhala and Bhatpara, Orissa. In coll. Ind. Mus., Calcutta.

*APHNÆUS CONCANUS*, n. sp.

**Male and female.** Nearest to the Ceylonese *A. lazularius*. Upperside similar. Underside pale reddish-ochreous; the bands dark purple-red, those on the forewing similar: hindwing with the subbasal band composed of three portions, the medial discal and submarginal bands disposed nearer together at their costal end, the submarginal straighter, and the three more or less confluent at their anal end.

Expanse  $1\frac{2}{3}$  to  $1\frac{1}{2}$  inch.

**HAB.** Bombay (*Dr. Leith*); Canara (*Ward*); Nilgiris (*Lindsay*). In coll. F. Moore.

*APHNÆUS NIPALICUS*, n. sp.

**Male.** Upperside dusky violet-brown, the lower basal and discal areas dark slaty-blue; anal lobe red, the black spots speckled with silvery-white scales. Underside dull sulphur-yellow, the bands of a slightly darker somewhat purpurascens yellow; forewing with an oblique oval black ring near base of the cell, a black-lined bar across middle of the cell from the costal edge, an oblique discal band from the costal edge, broken, but not disconnected, at lower end of the cell, a short upper discal bar, and two shorter subapical bars beyond, a submarginal band and a slender broken lunular marginal line; all but the last traversed by an extremely slight silvery line; beneath the cell is a dusky brown fascia, and a dusky streak also is at end of the submarginal band: hindwing with a small spot at base of the cell, three transverse subbasal oval black rings, a transverse medial band, broken at lower end, then bent upward to abdominal margin, and ending in a small ring-spot, and outer discal



upper band, a narrower submarginal band broken above anal angle and bent upward, all traversed by an extremely slight silvery line; anal lobe-spots large, black, surmounted by bright scarlet.

Female. Upperside paler dusky olive-brown: forewing with subapical darker spot bordered on each side by red; basal area below the cell slaty-grey: hindwing with the lower basal area slaty-grey; anal lobes as in male. Underside as in male.

Expanse ♂  $1\frac{1}{2}$ , ♀  $1\frac{3}{8}$  inch.

HAB. Nepal (*Ramsay*). Sikkim. In coll. British Museum, and Indian Museum, Calcutta.

Nearest allied to *A. lunulifer*.

*APHNÆUS ZEBRINUS*, n. sp.

Male. Upperside dark brown, base of wings dark brownish violet-blue; anal black spot large, broadly bordered with red. Female. Upperside darker violet-brown, base of wings dark slaty violet-blue. Underside very pale ochreous, posterior border of forewing whitish. All the bands purplish-black, as in *A. zoilus*; forewing with the extreme costal edge black, the bands also extending from the costal edge; basal streak long and joined to the black costal border, with a cross bar from its upper end, and a band crossing the middle of the cell (both of which join the streak below the base of the cell), the oblique discal band and the transverse submarginal band are joined together at their lower end, and the two short upper discal bars are also joined together, the marginal band is broad with a very narrow interline between it and the submarginal band; hindwing with the upper basal streak slender, the subbasal band entire and continued to the angle of the discal band above the bright red anal area, black lobe-spots large, the discal and outer bands broad.

Expanse ♂  $1\frac{1}{8}$ , ♀  $1\frac{3}{8}$  inch.

HAB. Ceylon. In coll. British Museum.

Nearest allied to the Andamanese species, *A. zoilus*. Distinguishable from it by its smaller size, by the bands on the forewing all starting from the extreme costal edge, by the oblique discal band and the submarginal band being broadly joined at their base, and by the marginal band being broader on both wings.

*APHNÆUS LILACINUS*, n. sp.

Male. Upperside brown: forewing with the basal and discal area, including the cell, pale lilacine-blue; a blackish spot at end of the cell: hindwing with the basal and medial area pale lilacine-blue; anal lobe

ochreous, with a very small silver-speckled black spot. Underside pale brownish-ochreous: forewing with two black rings in the cell, a band at end of the cell dilated beneath and extending obliquely to the submedian, a ringlet spot beyond end of the cell, an upper discal inwardly oblique double ringlet spot and a submarginal broad chain-like band, the lower ends dusky, and each traversed by a black silvery streak: hindwing with very indistinct traces of darker-coloured transverse subbasal, discal, and submarginal bands, which are traversed by silvery black streaks; anal spots minute, silver-speckled. The silvery streak traverses the middle of the markings, except on the submarginal band of both wings, where it extends along the outer border.

Expanse,  $1\frac{3}{10}$  inch.

HAB. ? In coll. Indian Museum, Calcutta.

EUASPA, n. g.

Forewing short, broad, costa arched from the base, exterior margin erect, convex, posterior margin long, straight; first subcostal emitted at two-sixths and second at one-sixth before end of the cell, second bifid at two-thirds from its base, fourth and fifth from end of the cell; discocellular very slender, erect, waved; radial from its middle; cell broad, extending to half length of the wing; middle median from near end of the cell, lower at one-third before the end, submedian straight: hindwing short, very broad, exterior margin convex and slightly sinuous, with a single slender tail from end of lower median; costal and subcostal veins joined together at their base, costal much arched from the juncture; cell broad, extending to half length of the wing; first subcostal emitted at one-fifth before end of the cell; discocellular very slender, erect; radial from near its middle; two upper medians from end of the cell, lower at one-third before the end; submedian curved, internal short, recurved. Body short; palpi porrect, second joint long, extending half beyond front of the head, pilose beneath, third joint slender, one-fifth as long as the second; legs slender; antennæ thickened at the end, tip blunt.

EUASPA MILIONIA.

*Myrina milionia*, Hewitson, Illust. D. Lep. p. 5, pl. 3, fig. 90, 80 (1869).

HAB. Nepal. Kangra.

Genus HYPOLYCENA.

Felder, Wien. Ent. Monats. vi, p. 293 (1862).

Male. Wings short, broad: forewing arched at the base, posterior margin nearly as long as the costal. Upperside with a large glandular

patch of scales extending broadly across end of the cell; four subcostal branches, the first emitted at two-fifths, second at one-fourth, and third from close before end of the cell; discocellular slender, straight; radial from its middle; cell extending to more than half length of the wing; lower median emitted at nearly one-third and middle median from near end of the cell; submedian straight: hindwing short, somewhat produced hindward, anal lobe prominent; with a slender tail from end of lower median and another from the submedian; costal vein much arched at the base; first subcostal emitted at one-third before end of the cell; the cell broad and extending to half length of the wing; discocellular recurved; radial from its middle; lower median emitted at nearly one-half and middle median from near end of the cell; submedian straight; internal recurved. Palpi porrect, second joint stout, third joint very long, of nearly the same length as the second; legs slender; antennæ with a gradually thickened club.

Type, *H. tmolus*.

#### HYPOLYCÆNA TMOLOS.

*Hypolycæna tmolus*, Felder, Wien. Ent. Monats. vi, p. 293 (1862). Hewits., Ill. D. Lep. p. 49, pl. 21, figs. 3, 6.

HAB. Philippines.

#### HYPOLYCÆNA SIPYLUS.

*Hypolycæna sipylus*, Feld., Reise Novara, Lep. ii, p. 242, pl. 30, figs. 15, 16. Hewits., Ill. D. Lep. pl. 22, figs. 13, 14.

*Myrina sipylus*, Feld., Sitzb. Ak. Wiss. Wien, 1860, p. 451.

HAB. Amboina.

#### HYPOLYCÆNA THARRYTAS.

*Hypolycæna tharrytas*, Feld., Wien. Ent. Monats. vi, p. 294 (1862).

*Hyp. sisypheus*, Hewits., l. c. pl. 22, fig. 11, 12.

HAB. Luzon.

#### HYPOLYCÆNA ERYLUS.

*Polyommatus erylus*, Godt., Enc. Meth. ix, p. 633, (1823).

*Amblypodia erylus*, Horst., Catal. Lep. Mus. E. I. C. p. 111 (1829).

*Hypolycæna erylus*, Hewits., Ill. D. Lep. p. 49, pl. 21, figs. 1, 2, 4.

HAB. N. E. Bengal, Sikkim, Khasia Hills, Cherra Punji, Burmah, Malacca, Singapore.

## HYPOLYCÆNA ANDAMANA.

*Hypolycæna andamana*, Moore, P. Z. S. 1877, p. 589.

HAB. Andamans.

## HYPOLYCÆNA THECLOIDES.

*Myrina thecloides*, Feld., Wien. Ent. Monats. iv, p. 395 (1860).

HAB. Malacca, Singapore.

## HYPOLYCÆNA ASTYLA.

*Hypolycæna astyla*, Feld., Wien. Ent. Monats. vi, p. 294 (1862); Reise Novara Lep. ii, p. 243, pl. 30, figs. 17, 18,

HAB. Philippines.

## DRUPADIA, n. g.

Differs from typical *Hypolycæna* in the more triangular form of forewing, the costa being longer and more regularly convex, the exterior margin more oblique, and the posterior margin shorter and convex towards the base: hindwing somewhat shorter, the costa being very convex in the middle, the exterior margin truncated from the middle median, the male on the upperside with a prominent glandular patch of scales between the costal and subcostal veins, and with three tails, the middle one being long the others short. Second joint of palpi much longer and the third shorter and stouter.

Type, *D. ravindra* (*Myrina ravindra*, Horsf.).

## DRUPADIA BOISDUVALII, n. sp.

*Myrina lisias*, Boisduval, Spec. Gen. Lep. Pap. pl. 22, fig. 2 ♂ (*nec* Fabr.).

Male. Upperside: forewing purplish violet-brown, with a broad oblique transverse discal almost quadrate red band: hindwing cobalt-blue, darkest and purplish-violaceous anteriorly; costal border and abdominal margin violet-brown; cilia and tails edged with white.

Female. Upperside: forewing somewhat paler brown, the red band of the same width and quadrangular form as in male: hindwing pale violet-brown, the discal area somewhat red-streaked; above the tails are four black spots surmounted by lilac scales.

Underside: forewing ochreous-red, with a brighter red pale-bordered streak at base of the cell, a band across middle of the cell, another at its end, and a similar discal band which has a slightly dusky lunulated border at the upper outer end, a submarginal slender black slightly sinuous line: hindwing white, the costal border and apex being slightly red, with the basal and subbasal spots entirely black, a duplex slender black streak at end of the cell, a similar one above it, a discal zigzag duplex line, and

a single black submarginal line; a large anal and a subanal black spot surmounted by metallic-blue scales, which also traverse the intervening subanal space.

Expanse ♂  $1\frac{1}{2}$ , ♀  $1\frac{2}{3}$  inch.

HAB. Moulmein; Mergui. In coll. F. Moore and Indian Museum, Calcutta.

*Drupadia lisias* (Pap. *lisias*, Fabr.) badly figured in Donovan's Ins. of India, pl. 40, fig. 1,—is distinct from the above. Both sexes of the type of *D. lisias* are in the British Museum Collection.

#### DRUPADIA FABRICII, n. sp.

Female. Upperside: forewing violet-brown, with a slightly broader and more irregular-shaped oblique medial red band than in female of typical *D. lisias*, the band also having its outer border scalloped: hindwing paler brown, with grey-bordered anal marginal spots. Underside also differs from *D. lisias* in the apical area of forewing being suffused with a dusky tint; at the base of the cell is a small round pale-bordered spot, not an elongated triangular mark as in *D. lisias*, the short band crossing the middle of the cell is black, the streak at end of the cell is more distinct, the transverse discal band black-lined and blackish internally at upper end, the submarginal line also being broader and more prominent: hindwing with the markings less prominent than in *D. lisias*, the basal bar shorter, the outer costal narrow streak further from the second, the first bar between the subcostals being midway below the two outer costals, the three subbasal spots are small and widely separated, the bar at end of the cell and the spot beneath it are pale-centred, the zigzag discal interrupted band is composed of duplex streaks, which are wide apart with the interspace white.

Expanse ♀  $1\frac{2}{10}$  inch.

HAB. Mergui. In coll. Indian Museum, Calcutta.

#### CHILIARIA, n. g.

Male. Wings small: forewing triangular; costa gently arched; exterior margin oblique, posterior margin straight; four subcostal branches, first emitted at one-third before end of the cell and slightly touching the costal vein near its end; second and third branches at equal distances apart; cell extending to nearly half length of the wing; discocellular extremely slender; one radial from near its middle; the middle median from near end of the cell, lower at one-third before the end; submedian nearly straight: hindwing short; apex convex, exterior margin oblique and waved; cell short, broad; costa arched from near

the base; first subcostal from near end of the cell; discocellular extremely slender, oblique; radial from its middle; two upper medians from end of the cell, lower at nearly one-half before the end; submedian straight; internal recurved; a slender tail from end of lower median and another from the submedian. Palpi porrect, second joint stout, third joint very slender; antennæ with a short spatular club.

Type, *C. othona*.

#### CHLIARIA OTHONA.

*Hypolycæna othona*, Hewits., Illust. D. Lep. p. 50, pl. 22, fig. 17, 18 (1865).

HAB. Darjiling. Khasia Hills.

#### CHLIARIA ELTOLA.

*Hypolycæna eltola*, Howits., Illust. D. Lep. Suppl. p. 14, pl. 5, fig. 37, 38 (1869).

HAB. Andamans.

#### CHLIARIA KINA.

*Hypolycæna kina*, Hewits., Illust. D. Lep. Suppl. p. 13, pl. 5, fig. 32, 34 (1869).

HAB. Sikkim. Nepal.

#### CHLIARIA CHANDRANA.

*Hypolycæna chandrana*, Moore, P. Z. S. 1882, p. 249, pl. xi, fig. 2, 2a.

HAB. Lahul, N. W. Himalaya.

#### CHLIARIA CACHARA.

*Hypolycæna cachara*, Moore, P. Z. S. 1883, p. 527, pl. xlix, fig. 6.

HAB. Cachar.

#### CHLIARIA NILGIRICA.

*Hypolycæna nilgirica*, Moore, P. Z. S. 1883, p. 527, pl. xlix, fig. 8.

HAB. Nilgiris.

#### SINTHUSA, n. g.

Male. Wings small: forewing somewhat broad, costa arched at the base, apex pointed, exterior margin slightly oblique and convex, posterior margin convex near the base; subcostal vein five-branched, first branch emitted at nearly one-half, second at one-fourth, and third from near the end of the cell, third bifid near its end; cell extending to half length of

the wing; discocellular slender; radial from its middle; lower median at more than one-third and middle median from near end of the cell; submedian straight: hindwing short, broad, costa arched in the middle, exterior margin with a single slender tail from end of lower median; cell broad, triangular, extending half the wing; first subcostal at one-half before end of the cell; discocellular oblique, slender; radial from its middle; lower median at nearly one-half and middle median from near end of the cell; submedian and internal veins recurved. Palpi porrect, second joint long, third joint short, slender, pointed; antennæ with a large thick pointed club.

Type, *S. nasaka*.

#### SINTHUSA NASAKA.

*Thecla nasaka*, Horsfield, Catal. Lep. Mus. E. I. C. p. 91 (1829).

*Deudorix nasaka*, Hewits., Illust. D. Lep. pl. 5, fig. 45, 46.

HAB. Java.

#### SINTHUSA MALIKA.

*Thecla malika*, Horsfield, Catal. Lep. Mus. E. I. C. p. 90 (1829).

*Dipsas malika*, Moore, Catal. Lep. Mus. E. I. C. I. pl. 1 a., fig. 5 (1857).

*Myrina malika*, Hewits., Illust. D. Lep. pl. 15, fig. 41—43.

HAB. Java. Sumatra.

#### SINTHUSA GROTEI.

*Hypolycæna grotei*, Moore, P. Z. S. 1883, p. 527, pl. 49, fig. 5.

HAB. N. E. Bengal (*Grote*).

#### Genus IOLAUS.

Hübner, Verz. bek. Schmett. p. 81 (1816-18).

Male. Forewing short, broad; costa very much arched from the base, apex acute, exterior margin very slightly oblique, posterior margin long, slightly convex in middle, the convex edge being fringed with long hairs; on the underside of the wing is a glandular patch of scales situated immediately above the submedian vein; cell broad, extending in length to half the wing; costal vein short; subcostal arched from the base, first branch emitted at one-half, second at one-fourth, and third immediately before end of the cell, third trifid at three-fourths from its base, fifth from end of the cell; discocellulars erect, upper shortest; radial from near their middle; the middle median emitted from near end of the cell, lower at one-fourth before the end; submedian straight:

hindwing short, lengthened hindward; costa very convex, apex almost angular, exterior margin very oblique and sinuous, lobate at anal angle, furnished with two short slender tails; on the upper side is a subcostal glandular patch of scales; costal and subcostal veins joined together for a short distance at their base, widely separated beyond, costal much arched from the basal juncture; cell broad, triangular; two subcostal branches, first emitted at one-third before end of the cell; discocellulars very oblique; radial from near their middle; two upper medians from end of the cell, lower at one-third before the end; median straight; internal short. Body moderate; palpi ascending, second joint long, ascending above level of the eyes, third joint half its length, slender; legs slender; antennæ slender, gradually thickened to end, tip pointed. . . .

Type, *I. helius* (*helius*, Fabr.; Hewits., Ill. D. L. Suppl. pl. 4, f. 31.)

The typical species of *Iolais* are African. The characters of the genus are here given for comparison with its Asiatic allies.

#### COPHANTA, n. g.

Forewing broad, costa arched, exterior margin slightly convex, posterior margin nearly straight; cell broad, extending to half length of the wing, costal vein extending to half the margin; first subcostal emitted at two-fifths and second at one-fourth before end of the cell, third bifid at nearly two-thirds from the base; discocellular slender, slightly bent outward in the middle; the radial from its angle; lower median at one-third and middle median from close before end of the cell; submedian straight: hindwing broad, costa abruptly arched at the base, apex convex, exterior margin oblique and sinuous from middle median, anal angle lobed, with a slender tail from lower median and another from submedian; costal and subcostal joined together for a short distance at the base, the costal much arched from above the juncture, and extending to the apex; first subcostal emitted at one-fifth before end of the cell; discocellular outwardly oblique and bent outward at the middle; the radial from its angle; cell broad, extending to nearly half the wing; lower median at one-third and middle median from immediately before end of the cell; submedian straight; internal recurved. Body short, thick; palpi porrect, second joint long, extending half length beyond the eyes, third joint slender, slightly fusiform, nearly half length of the second; antennæ short, stout, with a gradually thickened club; legs short.

Type, *C. illurgis*.



## COPHANTA ILLURGIS.

*Iolaus illurgis*, Hewitson, Illust. D. Lep. Suppl. p. 10, pl. 4, fig. 37, 38 (1869).

HAB. Darjiling.

## COPHANTA MACULATA.

*Iolaus maculatus*, Hewits., Illust. D. Lep. p. 47, pl. 21, fig. 29, 30 (1865).

HAB. Silhet. Darjeeling.

## DACALANA, n. g.

**Male.** Forewing comparatively more triangular than in typical *Iolaus* (*I. helius*), the exterior margin being somewhat oblique, and the posterior margin shorter; venation similar; on the upperside of the typical species, between the median and submedian veins, is a tuft of fine hairs covering a small glandular-scaled spot, and on the underside there is also a tuft of hairs on the middle of the posterior margin: hindwing comparatively broader, being less produced hindward, the apex more convex, and the glandular subcostal spot less prominent.

Type, *D. vidura* (*Amblyp. vidura*).

## DACALANA VIDURA.

*Amblypodia vidura*, Horsf., Catal. Lep. Mus. E. I. C. p. 113, pl. 1, fig. 6, 6a. ♂, (1829).

HAB. Java. Borneo.

## DACALANA BURMANA, n. sp.

From typical Javan *D. vidura*, this differs in the darker blue of the upperside. The colour of the underside is also brighter and of an ochreous-brown tint, the transverse white band is somewhat broader, the submarginal black line composed of short curved portions between the veins, and the whole series forms a more curved line in crossing each wing; the black subanal and lobe-spot is slightly smaller, and the former is but very slightly surmounted with red.

Expanse ♂  $1\frac{1}{2}$  inch.

HAB. Moulmein. In coll. British Museum.

## DACALANA COTYS.

*Iolaus cotys*, Hewitson, Illust. D. Lep. p. 43, pl. 19, fig. 19, 20 (1865).

HAB. Nepal. Darjiling.

## Genus PRATAPA, Moore.

## PRATAPA BHOTEA, n. sp.

Female. Upperside purpurascent greyish-blue: forewing with the anterior margin from the costal vein, the apex broadly, and the exterior margin violet-brown; cilia grey: hindwing with a marginal row of narrow violet-black spots ending in a red anal lobe-spot; a slender black marginal line; cilia greyish-white; the two tails black with white cilia.

Underside glossy purpurascent greyish-white: forewing with an indistinct darker bluish-grey streak at end of the cell, and two slender lunular fasciæ along exterior margin; a transverse discal slender prominent black broken sinuous line: hindwing with a similar cell streak and outer marginal fasciæ, the latter darkest at anal end; a jet black anal lobe-spot, on which are a few scarlet scales and some turquoise-blue scales along its inner border; a transverse discal zigzag slender black broken line ending upward above the anal lobe.

Expanse  $1\frac{1}{2}$  inch. .

HAB. Sikkim. In coll. Indian Museum, Calcutta.

## REMELANA, n. g.

Male. Forewing less triangular than in *Tajuria* (*T. longinus*, Fabr.), the costal margin more abruptly arched at the base, exterior margin slightly convex, posterior angle rounded: hindwing broader and less produced hindward; costa less arched at the base, very convex externally, with a slender tail from end of lower median and another from the submedian, abdominal margin short. Palpi shorter, second joint stouter, and third joint longer; antennæ shorter, tip shorter and more regularly clavate. Venation similar.

Type, *R. jangala*.

## REMELANA JANGALA.

*Amblypodia jangala*, Horsfield, Catal. Lep. Mus. E. I. C. p. 113 (1829), ♀; Moore, ibid. p. 40, pl. 1 a, f. 11, ♂.

HAB. Java. N. E. Bengal.

## REMELANA TRAVANA.

*Myrina travana*, Hewitson, Illust. D. Lep. p. 38, pl. 17, f. 59-60 (1865) ♂.

HAB. Sumatra. Singapore. Borneo.

## APPORASA, n. g.

From *Thaduka* this differs in the forewing having the exterior margin biangulated and produced outward below the apex. In the hindwing the costa is longer, arched at the base, and produced to an upward angle at the apex; the exterior margin is deeply scalloped; it also has three shorter tails. Palpi long, porrect, second joint extending two-thirds beyond the eyes, third joint also long and slender, being half the length of second; antennæ stouter and blunt at tip.

## APPORASA ATKINSONI.

*Amblypodia atkinsoni*, Hewits., Catal. Lyc. Brit. Mus. p. 3. pl. 8, fig. 92, 93 (1862).

HAB. Moulmein.

## SATADRA, n. g.

Forewing comparatively longer and narrower than in typical *Panchala*, the costa abruptly arched at the base, exterior margin oblique: hindwing slightly but regularly arched along the costa, apex very convex, exterior margin oblique, with a slender tail at end of lower median vein and a point at end of both the middle median and submedian. Venation similar to that of *Panchala*.

Type, *S. atrax*.

## SATADRA ALEA.

*Amblypodia alea*, Hewits., Catal. Lyc. B. M. p. 12, pl. 7, fig. 79, 81 (1862).

HAB. India.

## SATADRA SELTA.

*Amblypodia selta*, Hewits., Ill. D. Lep. p. 14. pl. 3a, f. 36, 37 (1869).

HAB. Moulmein.

## SATADRA AGABA.

*Amblypodia agaba*, Hewits., Catal. Lyc. B. M. p. 8, pl. 4, f. 39, 40 (1862).

HAB. India.

In the Hewitson Cabinet this species is placed under *S. alea*.

## SATADRA BUPOLA.

*Amblypodia bupola*, Hewits., Ill. D. Lep. ii. Suppl. p. 21, pl. 8, fig. 44, 45 (1878).

HAB. Nepal. Darjiling.

## SATADRA BAZALUS.

*Amblypodia bazalus*, Hewits., Catal. Lyc. B. M. pl. 4, fig. 37, 38 (1862) ♂.

HAB. Nepal.

## SATADRA ATRAX.

*Amblypodia atrax*, Hewits., Catal. Lyc. B. M. p. 13, pl. 7, fig. 80, 82 (1862).

HAB. Nepal.

## SATADRA ANTHELUS.

*Amblypodia anthelus*, Doubleday and Hewits., Gen. D. L. pl. 74, f. 6 (1852).  
Hewits., Catal. Lyc. B. M. pl. 3, f. 23. 24.

HAB. Moulmein.

## SATADRA CANARAICA, n. sp.

Allied to *S. alea* (*Amblypodia alea*, Hewits.). Male and female. Upperside of a more purplish violet-blue than in *S. alea*, the marginal black border comparatively narrower in the male. Underside of a darker purplish violet-brown: forewing with the basal spots darker, the two cell-spots very small and round, the discocellular spot and the two below the cell narrower, the transverse discal band regular and not broken on the upper median vein, the submarginal and marginal lunules obsolescent: hindwing with the basal and subbasal spots darker and very small, the discal zigzag band narrower and less distinct, the submarginal and marginal lunules obsolescent; anal angle less speckled with metallic-green scales, the anal black spot only present.

Expanse ♂  $1\frac{3}{8}$ , ♀  $1\frac{1}{8}$  inch.

HAB. Canara, S. India (Ward). In coll. F. Moore.

In *S. alea* the underside is uniformly purplish-brown, the markings all of a regular colour and distinctly lined with pale purplish-white.

## SATADRA CHOLA, n. sp.

Closely allied to *S. areste* (*Amblypodia areste*, Hewits.). Male. Upperside of a comparatively darker purplish blue, the marginal black borders being one half less the width. Female. Upperside also with the blue area extending comparatively more over the disc. Underside: forewing more dusky olive-brown in colour, with much narrower whitish cell-streak, quadrate spot beneath it, and transverse discal band, the outer band being more defined: hindwing with similarly disposed markings except that the subbasal band is very broad and entire (not

macular as in *S. areste*), and the markings are all of a dark somewhat aenescant-brown, with pale pinkish-white borders and the interspaces pale pinkish violet colour (not grey as in *S. areste*); at the anal angle is a marginal black spot and another between the middle and lower median veins, both spots and the intervening marginal space speckled with metallic-green scales.

Expanse ♂ ♀  $1\frac{6}{10}$  inch.

HAB. Sikkim. In coll. Indian Museum, Calcutta, and F. Moore.

*SATADRA LAZULA*, n. sp.

Male. Upperside of both wings entirely ultramarine-blue; the extreme costal edge of forewing, the costal and abdominal borders of hindwing, and the cilia being black.

Female. Dark violet-brown, the forewing with ultramarine-blue within the cell and obliquely below on the disc, and narrowly on middle of the hindwing from base of the cell. Underside dark purple-brown: forewing with similarly disposed but broader markings than those in *S. chola*, the two outer bands purplish-violet: hindwing dark purple-brown, with similar markings to those in *S. chola*, the discal bands continuous, the interspaces brighter pink, the anal marginal spots small and more numerous green-speckled.

Expanse  $1\frac{8}{10}$  inch.

HAB. Sikkim. In coll. Indian Museum, Calcutta, and F. Moore.

*SATADRA PATUNA*, n. sp.

Female. Smaller than *S. lazula*. Upperside dark violet-brown, the basal and discal areas purplish-blue, paler than in *S. lazula*, but disposed as in female of that species. Underside purplish-brown: forewing with similarly disposed cell, streak, discal band, and lower quadrato patches, but of a pale ochreous colour: hindwing with the basal area broadly and entirely dark bright purple-brown (more like that of typical *S. apidanus*), which merges into a transverse broad pale purplish-ochreous inner discal fascia, and again into a dark purplish-brown outer discal fascia, the outer border of the wing being broadly pale purplish-brown; across the disc are traced two series of indistinct brown-lined marks, which are similarly disposed to, but are less continuous than, those in *S. lazula*; an indistinct brown marginal lunular line, but no metallic speckles at anal angle.

Expanse  $1\frac{1}{2}$  inch.

HAB. Nepal (*General Ramsay*). In coll. F. Moore.

## SATADRA CÆCA.

*Amblypodia cæca*, Hewits., Ill. D. Lep. p. 14, pl. 4, fig. 28 (1863).

HAB. Bornco (Sarawak).

## SATADRA ARESTE.

*Amblypodia areste*, Hewits. Catal. Lyc. B. M. pl. 5. f. 43, 44 (1862).

HAB. Darjiling.

## SATADRA FULGIDA.

*Amblypodia fulgida*, Hewits., Ill. D. Lep. p. 11, pl. 5, fig. 31 (1863).

HAB. [? Philippines]. N. India.

## SATADRA CHINENSIS.

*Arhopala chinensis*, Feld., Reise Novara Lep. ii. p. 231, pl. 29, f. 10 (1865).

HAB. China.

## SATADRA DIARDI.

*Amblypodia diardi*, Hewits., Catal. Lyc. B. M. p. 9, pl. 5, f. 41, 42, (1862).

HAB. Penang. Singapore.

## SATADRA APIANUS.

*Papilio apidanus*, Cram., Pap. Exot. ii. pl. 137. f. F. G. (1779)

*Amblypodia apidanus*, Horsf., Catal. Lep. Mus. E. I. C. p. 100 (1829).

HAB. Java. Sumatra. Borneo.

## SATADRA ABSENS.

*Amblypodia absens*, Hewits., Catal. Lyc. B. M. p. 9, pl. 5, f. 51, 52 (1862).

HAB. Darjiling.

## SATADRA ZETA.

*Amblypodia zeta*, Moore, P. Z. S. 1877, p. 590, pl. 58, f. 6.

HAB. Andamans.

## ACESINA, n. g.

Forewing with the costa less arched than in *Panchala*, apex less pointed, exterior margin more oblique, and waved; fourth subcostal vein emitted further from end of the third: hindwing not so broad or quadrate in shape, the costa but slightly arched from the base, exterior margin more oblique and regularly convex, with a slender tail one-fourth of an inch long from end of lower median vein; abdominal margin shorter. Antennal club somewhat shorter.

Type, *A. paraganesa*.

## ACESINA PARAGANESA.

*Amblypodia paraganesa*, De Nicéville, Journ. Asiat. Soc. Bengal, 1882, p. 63.

*Panchala paraganesa*, Moore, P. Z. S. 1883, p. 530.

*Amblypodia ganesa*, Hewits., Catal. Lyc. B. M. pl. 7, f. 72 (1862).

HAB. Nepal.

## DARASANA, n. g.

Forewing short, broad, triangular; apex acute, exterior margin very slightly oblique, posterior angle somewhat rounded: hindwing short, broad; costa arched towards the base, exterior margin very convex; no tail. Antennæ slender.

Type, *D. perimuta*.

## DARASANA PERIMUTA

*Amblypodia perimuta*, Moore, Catal. Lep. Mus. E. I. C. I, p. 42 (1857). Hewits. Catal. Lyc. B. M. p. 12, pl. 6, fig. 65, 66.

HAB. Khasia Hills. Magaree, Pegu

## DARASANA NEWARA, n. sp.

Upperside violet-brown: forewing with the basal and discal area purplish violet-blue, which extends also above the cell to near the costal edge, the outer brown border being about one-tenth of an inch in width: hindwing with the basal area purplish violet-blue, the outer border being two-tenths of an inch in width. Underside pale-brown; with faint traces of pale-bordered marks within and beneath the cell, at its end, and a more distinct narrow macular discal and submarginal lunular band: hindwing with four indistinct pale-bordered darker brown basal spots, a similar subbasal series, a discal broken band, and marginal double lunular band.

Expanse  $1\frac{2}{10}$  inch.

HAB. Nepal (*Genl. Ramsay*). In Coll F Moore.

## Genus NARATHURA, Moore

## NARATHURA ROONA, n. sp.

Closely allied to, but smaller than *N. aroa* (*Amblypodia aroa*, Hewits., Ill. D. Lep. p. 13, pl. 2, f. 12), from Sumatra. Female. Upperside dark violet-brown, costal edge and cilia paler: forewing with the basal and discal area, and the hindwing with the basal and medial discal area, violet-blue. Underside of a similar tint of brown to that in *N. aroa*, markings also similarly disposed, but with darker centres; on the forewing

the cell-spots are smaller and oval in shape, and the discal band broader ; on the hindwing the basal spots are more rounded, the discal band more conspicuous and less zigzag in shape, and the submarginal and marginal lunular line more distinctly formed ; at the anal angle is a black spot and another between the median veins, the spots and intervening space being speckled with metallic-green scales.

Expanse  $1\frac{3}{8}$  inch.

HAB. Andaman Isles. In coll. Indian Museum, Calcutta, and British Museum (Hewitson Cabinet).

Genus AMBLYPODIA, Horsfield.

AMBLYPODIA ANDERSONII, n. sp.

Male. Smaller than *A. taooana*. Upperside of a similar tint of ultramarine-blue ; both wings with a much narrower black marginal border. Underside much darker-coloured, but similarly marked.

Expanse  $1\frac{1}{8}$  inch.

HAB. Sampu, Mergui (*Dr. Anderson*). In coll. Ind. Mus., Calcutta.

Family PAPILIONIDÆ.

Subfamily PIERINÆ.

Genus CATOPHAGA, Hübner.

CATOPHAGA WARDII, n. sp.

Allied to the South Indian and Ceylonese *C. neombo*. Male and female of much larger size.

Male. Upperside olivaceous-white : forewing with a broad black apical band extending from middle of the costa to near the posterior angle, the band traversed by a curved subapical row of five small white spots, the inner border of the band excavated below the costa to below the second upper spot, then bulged inward to the disc in front of the two lower spots, concave below the middle median to lower median, below which the end of the band is imperfect and terminates on the submedian ; base of wing broadly grey and sparsely speckled with minute black scales on base of the costa : hindwing with a marginal series of broad black confluent dentate spots, which decrease in width from the costa. Underside : forewing olivaceous-white, apex pale yellow, with a curved black subapical band similar to the inner portion on the upperside : hindwing pale yellow throughout.

Female. Upperside of a darker tint of olivaceous-white than in male : forewing with a broader black apical band, which is traversed by



three subapical white spots, the inner border of the band being less excavated below the costa, the excavated space being shorter and angular on the middle median; more deeply concave beneath it, and the end entirely black to the submedian vein: hindwing with a broader continuous black band, the inner border of which is acutely dentated. Underside: forewing with the basal area tinged with yellow, the discal area olivaceous-white, and the apex glossy olivaceous-white; a broad curved subapical black band corresponding to the inner portion on the upperside: hindwing entirely pale glossy olivaceous-white.

Expanse ♂, ♀  $2\frac{5}{8}$  inches.

HAB. Coonoor, Nilgiris, S. India (*Ward and Lindsay*). In coll. Indian Museum, Calcutta, and F. Moore

*CATOPHAGA ROEPSTORFFII*, n. sp.

Male. Upperside white: forewing slightly grey and sparsely black-scaled along base of costal border; a black speckled spot between upper and middle median veins. Hindwing immaculate. Underside: forewing white, apex very pale yellow; the black-speckled spot as above: hindwing very pale yellow.

Expanse  $2\frac{3}{8}$  inches.

HAB. Nicobar Isles. In coll. Indian Museum, Calcutta.

Near to *C. paulina*. Male. Differs from the same sex of that species in the entire absence of the blackish apical margin on the forewing, and in the presence of the discal spot.

Genus *IXIAS*, Hubner.

*IXIAS GANDUCA*, n. sp.

Male and female. Upperside deep sulphur-yellow: male: forewing with the apex brownish black traversed by a moderately broad orange-red subapical band, the inner border of the band being very slightly edged with black: hindwing with a very slender black-speckled marginal band.

Female: forewing with a narrower and more irregular-bordered subapical band, which is slightly tinged with orange-yellow, the inner border of the band is broadly black across end of the cell, and from the upper median to the indentation of the lower portion of the band the border consists of a very slender black-speckled line, the lower portion of the band is indented with black, the next upper interspace has a medial black spot, and the third upper interspace is broken by a large black spot: hindwing with a broader dentate-bordered black marginal band. Under-

side of both sexes ochreous-yellow, palest on base of the forewing; both wings with sparsely disposed slender brown strigæ: forewing with a blackish spot at end of the cell, a transverse discal row of purple-brown-speckled spots with white centres: hindwing with a similar white-centred purple-brown-speckled costal spot and row of discal spots, the second and third upper spots being the largest: a brown dot also at end of the cell.

Expanse ♂ 2, ♀  $2\frac{1}{8}$  inches.

HAB. Calcutta (February). In coll. Indian Museum, Calcutta.

Nearest to, but distinct from, *I. moulmeinensis*. The male differs from it above in the comparatively narrower orange-red band and its less black inner border. The female also is quite different from the same sex of that species.

#### Genus IDMAIS, Boisd.

##### IDMAIS SURYA, n. sp.

Nearest to *I. oriens*. Male larger, upperside much brighter-coloured, the black apical band broader, and is traversed by three spots only, which are comparatively shorter; the marginal spots are more prominent, the black inner border terminating on the upper median as in *I. oriens*; below the three subapical spots are two black spots. Cell-spot on forewing three times the size of that in *I. oriens* on both the upper and underside: hindwing with six marginal black spots, larger than in *I. oriens*. Underside much brighter-coloured than in *I. oriens*; base of both wings deep yellow, the outer borders broadly suffused with orange-red, the discal macular band similar but much less prominent on the hindwing.

Expanse  $1\frac{6}{8}$  inch.

HAB. Sonakhala, Orissa. In coll. Indian Museum, Calcutta.

#### Genus MANCIPIUM, Hübner

##### MANCIPIUM NAGANUM, n. sp.

Male. Upperside pale yellowish-white; forewing with the base of the costal border sparsely black-speckled; a black band at the apex, the inner border of the band being curved, slightly irregular, and terminating at the middle median vein; a small black discal spot between the upper and middle medians, and a slight black-speckled spot at lower end of the cell. Underside: forewing white, with the apex pale yellow, the discal and discocellular spot as on upperside: hindwing yellow.

Expanse 2 inches.

HAB. Naga Hills, Assam. In coll. Indian Museum, Calcutta.

## Genus APPIAS, Hübner.

## APPIAS AMBOÏDES, n. sp.

Male. Upperside white: forewing with a narrow apical black band. Underside: forewing white, the costal border, and apex corresponding to the band on upperside, pale brownish-ochreous: hindwing entirely pale brownish-ochreous, with a slight indistinct dusky fascia extending from the base along the subcostal and median vein.

Expanse  $1\frac{1}{2}$  inch.

HAB. Silhet. Dihung, Assam. In coll. Indian Museum, Calcutta, and F. Moore.

## Genus HIPOSCRTIA, Hübner.

## HIPOSCRTIA IMBECILIS, n. sp.

Male. Upperside white: forewing with a black-speckled apical band, which is traversed by four subapical white spots. Underside: forewing white, with the apex ochreous-white and slightly speckled with ochreous-brown scales: hindwing ochreous-white, sparsely speckled with ochreous-brown scales with slight traces of their clustering on the anterior margin near end of the costal and subcostal veins and across the disc in an indistinct zigzag fascia; a small blackish spot at end of the cell.

Expanse  $1\frac{3}{4}$  to 2 inches.

HAB. Silhet; Assam. In coll. Indian Museum, Calcutta, and F. Moore.

Allied both to *H. indra* and to *H. muthana*. Distinguished from the latter by its smaller size. Forewing with paler and less defined blackish apical band. No subapical curved black fascia on the underside.

## Subfamily PAPILIONINÆ.

## Genus PAPILIO, Linn.

## PAPILIO LADAKENSIS, n. sp.

Male. Distinguished from the N. W. Himalayan *P. asiaticus* by the absence of the elongated tail on the hindwing, which in this form is reduced to a short point but little more acute than the anal angle. The forewing is comparatively narrower, and the hindwing is less convex and with less acutely sinuous exterior margin. On the upperside the yellow is also of a paler tint: forewing numerously covered with yellow scales between all the markings, the cell bands are shorter transversely and broader, and the inner cell-band is regularly quadrate; the discal bands

also comparatively narrower and with more slender intervening black veins; the marginal row of spots is broader, and the intervening transverse discal area is narrower: hindwing with the outer border of the yellow basal area excavated between the veins, the marginal spots shorter and somewhat broader, the anal lobe-spot also smaller and broader.

Expanse  $3\frac{1}{4}$  inches.

HAB. Tarhsam, Ladak. In coll. Indian Museum, Calcutta.

PAPILIO SIKKIMENSIS, n. sp. •

Differs from N. W. Himalayan and Nepalese specimens of *P. asiaticus* in the very much darker black colour of the upperside; and in the forewing having the yellow cell-bands quadrate in form, the discal band composed of smaller and shorter portions, and the area intervening between the band and the marginal spots broader. On the hindwing, the veins are broadly black-lined, the abdominal border also black and leaving but a small subanal lunule; the discal margin of the yellow area has a more regularly scalloped edge, and there is also a broader discal area intervening between it and the marginal spots; the crimson anal lobe-spot is smaller, narrower, and has a lower retort-like black spot.

Expanse  $2\frac{1}{2}$  to  $3\frac{1}{2}$  inches.

HAB. Sikkim (*Elwes*).

Family HESPERIIDÆ.

CUPITHA, n. g.

Male. Forewing elongated, triangular, costa arched at the base, exterior margin oblique, posterior margin convex towards the base; first subcostal emitted at nearly one-half before end of the cell, the branches at equal distance apart; cell extending to nearly two-thirds length of the wing; discocellular almost erect, slightly bent close to upper end and below the middle; upper radial from the angle near subcostal, lower radial from the angle below the middle; the middle median at one-sixth, and lower median at four-sixths before end of the cell, submedian undulated; on the underside of the forewing is a short, broad, nacreous patch on the middle of posterior margin, across which the submedian is lined with rough scales, and from near the base of the margin projects a broad pencil of long rigid hairs: hindwing short, costa very much arched from the base, apex rounded; costal vein extending to near apex, forked at its base; subcostal bent upward and slightly joined to costal close to the base, subcostal two-branched, first branch from close to end of the cell; discocellular very slender, slightly oblique and concave; cell extending

to nearly half the wing, of equal width throughout; middle median from near end of the cell, lower at more than one-half before the end, the portion from the middle median to lower median distorted and extending beneath a drum-like glandular sac, which extends upward in a circular form within the cell from base of lower median, the sac, or drum, as seen from the upperside, is flat, with a well-defined circular rim, and on the underside, it stands out from the surface in a corrugated circular form; no radial present; submedian straight; internal vein curved.

Thorax stout; antennæ with a slender club.

Type, *C. tympanifera*.

#### CUPITHA PURREEA.

*Pamphila Purreea*, Moore, P. Z. S. 1877, p. 564, pl. 58, fig. 10, ♀. Wood-Mason, Journ. Asiat. Soc. Bengal, 1881, p. 261.

HAB. South Andaman.

#### CUPITHA TYMPANIFERA, n. sp.

Male. Upperside dark violet-brown; forewing with a broad gamboge-yellow basal costal band, and an oblique discal sinuous-bordered band extending upward from near base of the posterior margin to near the apex: hindwing with a broad transverse discal yellow band extending from near the abdominal margin to near the apex and thence upward along the costal border. Cilia yellow. Body brown; abdomen with yellow bands. Underside deep gamboge-yellow: forewing with a short ochreous-brown streak extending longitudinally from the base to end of the cell, and a broad patch at the posterior angle: hindwing with a similarly coloured speckled patch near anal angle ascending upward from end of submedian vein. Palpi and legs yellow, antennæ annulated with yellow.

Expanse ♂  $1\frac{2}{3}$ .

HAB. Magaree, Pegu. In coll. F. Moore.

This is a comparatively larger insect than *C. purreea*; the bands on the forewing are broader and with more irregular borders, the bands on the hindwing are also broader.

#### Genus PLESIONEURA, Felder.

#### PLESIONEURA MUNDA, n. sp.

Male and female. Upperside olive-brown: forewing with an oblique transverse discal semidiaphanous white band, similar to, but more compact than that in *P. leucocera*, the apex-spot starting from above the costal vein, the two lower large spots, the small one beneath, as well as that outwardly between them, are not separated from each other, the

second lower spot between the median and submedian only being apart from the rest; three subapical conjoined white spots and two minute lower dots; cilia very faintly alternated brownish-white: hindwing uniformly olive-brown: cilia deeply alternated with white. Underside paler than above: forewing marked the same: hindwing numerously speckled with olive-green scales towards abdominal margin; an olive-green-speckled lunule at end of the cell.

Expanse  $1\frac{1}{2}$  inch.

HAB. Simla (*Lang*). In coll. F. Moore.

Genus SUASTUS, Moore.

SUASTUS ADITUS, n. sp.

Male. Upperside dark violet-brown: forewing with two small quadrate yellow spots at end of the cell, a larger spot immediately beneath end of the cell between the middle and lower medians, and a small spot between the base of upper and middle medians; between the lower median and submedian is a very slight trace of an opaque yellowish streak; cilia edged with grey. Underside paler brown: forewing with the spots as above, and a whitish discal patch below them: hindwing speckled with olive-grey scales, which are most thickly disposed along the abdominal border and form a distinct line along the submedian vein; two dark brown discal spots, one being situated between the middle and lower medians, the other between the latter and submedian. Body, palpi, and legs beneath olivaceous-grey.

Expanse  $1\frac{2}{3}$  inch.

HAB. Andaman Isles. In coll. Indian Museum, Calcutta.

Allied to *S. sala* (*Hesperia sala*, Hewits.).

SUASTUS MÖLLERII, n. sp.

Male. Upperside very dark olive-brown: forewing with three small narrow white semidiaphanous subapical spots, a larger narrow spot at lower end of the cell, a still larger spot below end of the cell, and a small very slender spot between base of upper and middle medians; a small yellowish opaque spot also above middle of the submedian: hindwing with the abdominal border broadly paler olive-brown. Cilia cinereous-white. Underside: forewing dusky-black, the costal border and apical area pale olive-brown; spotted as above: hindwing very pale olive-brown, with the interspace between submedian and internal veins white. Palpi beneath, and legs, and abdomen beneath, white.

Expanse  $1\frac{1}{2}$  inch.

HAB. Sikkim (*Otto Möller*). In coll. Indian Museum, Calcutta.

## Genus SATARUPA, Moore.

## SATARUPA PHISARA n. sp.

**Male.** Upperside dark vinous-brown: forewing with two, sometimes three or four, minute semidiaphanous yellowish white subapical spots, a small spot at lower end of the cell, a large quadrate spot below end of the cell, and a small spot also between the base of upper and middle medians; a very indistinct greyish-brown-speckled submarginal lunular fascia and a similar short fascia below the quadrate discal spot: hindwing with a transverse subbasal pale yellowish band, and a curved submarginal indistinct greyish-brown-speckled lunular fascia, which gives the discal area a macular appearance. **Female:** forewing marked as in male, the short fascia below the discal spot more distinct: hindwing with the transverse band somewhat broader, the discal area between it and the submarginal lunular fascia more distinctly macular, being traversed by pale veins. Underside as above, the markings more prominent. Abdomen with slender white narrow bands; front of head and base of palpi, and pectus, orange-yellow, tip of palpi black.

Expanse ♂  $1\frac{5}{16}$ , ♀  $1\frac{1}{16}$  inch.

**HAB.** Khasia Hills. In coll. Indian Museum, Calcutta, and F. Moore.

Allied to *S. bhagava* and to *S. sambara*.

## SATARUPA NARADA, n. sp.

Upperside purpurascient violet-brown: forewing with three small upper and two lower subapical semidiaphanous white spots, a small erect oval spot at lower end of the cell, a slightly larger quadrate spot on the disc between upper and middle medians, and a broad band formed of three quadrate spots increasing in width from end of cell to posterior margin: hindwing with a broad white transverse medial band, the outer border with an ill-defined upper spot. Cilia edged with white. Underside marked as above; the hindwing with the band showing a more defined macular outer border and a well separated upper spot.

Expanse  $1\frac{4}{16}$  inch.

**HAB.** Darjiling, Sikkim. In coll. Indian Museum, Calcutta, and F. Moore.

Nearest allied to *S. bhagava*, but quite distinct.

## Genus TAGIADES, Hübner.

## TAGIADES KHASIANA, n. sp.

Male. Nearest to *T. ravi*. Of larger size: forewing comparatively more pointed at the apex: hindwing also broader, and with a more angular apex. Upperside of a paler olivaceous-brown, the dusky markings less distinct on both wings, the apical and discal spots smaller. Female upperside also paler than in *T. ravi*, the apical spots on forewing somewhat smaller, the cell spots similar, the two discal spots somewhat larger.

Underside: forewing with the spots, as above: hindwing more intensely whitish grey, the discal black spots much smaller and less defined.

Expanse ♂ 2, ♀  $2\frac{1}{10}$  inches.

HAB. Khasia Hills; Shillong; Assam. In coll. Indian Museum, Calcutta, and F. Moore.

## LOBOCIA, n. g.

Male. Forewing triangular, the edge of the costal margin slightly folded over on to the upperside from near the base to end of the costal vein;\* the costal vein extending to three-fifths the margin; subcostal five-branched, first branch emitted at one-third before end of cell, second and third at equal distances from the first, fourth and fifth from end of the cell: discocellular bent outward near upper end and inwardly oblique hindward; upper radial from the angle near subcostal, lower radial from the middle; cell long, extending beyond two-thirds the wing; three medians, lower at three-fourths and middle median at about one-fourth before end of the cell; submedian straight: hindwing short, broad, apex rounded, exterior margin slightly produced and angular at end of submedian vein; costal vein extending to the apex; subcostal touching the costal close to the base, two-branched, first branch at one-fourth before end of the cell; discocellular very slender, almost erect; the radial from its middle; cell broad, extending to half the wing; two upper medians from end of the cell, lower at about one-third before the end; submedian and internal vein nearly straight. Body short, stout, thorax hairy; palpi broad, thickly clothed, apical joint short, thick; antennæ with a long slender-pointed tip; femora and tibiæ short, stout, slightly pilose, middle tibiæ with two and hind with four spurs, tarsi long.

Type, *L. liliana*.

\* The species of *Erynnis* (*E. alcea*, etc.) have a similar fold on the costal margin of the forewing.



## LOBOCLA LILIANA.

*Plesioneura liliana*, Atkinson, P. Z. S. 1871, p. 216, pl. xxii, fig. 2.

HAB. Yunan.

## LOBOCLA CASYAPA, n. sp.

Differs from *L. liliana* in its smaller size. Upperside somewhat paler and of an olive-brown tint, sparsely speckled with olive-grey scales: forewing with the transverse semidiaphanous yellow band one-third less in width, the portions being distinctly defined by the traversing brown veins, the subapical spots also much smaller. Underside much paler: forewing numerous speckled with greyish-ochreous scales at the apex, the band and apical spots as above: hindwing with similarly disposed markings, but all composed of more numerous greyish-ochreous scales, these scales being whitish in *L. liliana*.

Expanse  $1\frac{9}{10}$  inch.

HAB. Masuri (*Lang*). Cashmere (*Reed*) In coll. Indian Museum, Calcutta, and F. Moore.



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### Part II.—NATURAL SCIENCE.

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III.—*Account of the South-West Monsoon Storms of the 26th June to 4th July and of 10th to 15th November 1883.*—By JOHN ELIOT, M. A., Meteorological Reporter to the Government of Bengal.

[Received June 4th;—Read July 2nd, 1884.]

(With Plates II—X.)

#### CHAPTER I.

##### INTRODUCTION.

It is proposed in the following paper to give an account of the two most important and remarkable storms that occurred in the Bay of Bengal during the year 1883. The first storm was generated during the last week of June near the Head of the Bay and gave very stormy weather off the Bengal and Orissa coasts, and was the only occasion on which it was necessary to hoist the storm signals at the Saugor Island station near the entrance to the Hooghly. The second storm was formed in the Gulf of Martaban during the second week of November, almost at the end of the south-west monsoon, and pursued a very unusual course. It crossed into the Bay of Bengal through the channel between Cape Negrais and the Andaman Islands. It then slightly recurved and moved in a general northward direction, approaching the Arracan coast near Akyab, where it was broken up by the action of the Arracan Hills.

The following is a list of all the cyclonic storms in the Bay of Bengal during the south-west monsoon period of the year 1883. They were all of comparatively small extent and intensity, or ordinary south-west monsoon storms accompanied with winds of force 8 to 10 at and near the centre.

1. Storm of June 13th to 20th at the commencement of the south-west monsoon, which gave the first heavy burst of rainfall to Behar. It formed near the Balasore coast on the 13th, and advanced into Behar, where it broke up on the 20th.

2. Storm of June 26th to 4th July. This was generated slowly near the Sandheads on the 26th and 27th, was of considerable intensity, and remained nearly stationary until the 29th. It crossed the Balasore coast early on the morning of the 30th.

3. Storm of July 6th to 8th. This was formed at or near the Sandheads under similar conditions to the preceding, but was of small intensity. It crossed the Balasore coast on the afternoon of the 7th.

4. Storm of the 12th to 14th July. This began to form on the morning of the 12th off the South Orissa coast, across which (between False Point and Gopalpore) the centre advanced on the evening of the 13th, or early on the morning of the 14th, into the Central Provinces. It was of slight intensity.

5. Storm of the 16th to 18th August. This was formed in the north-west angle of the Bay, and crossed the North Orissa coast near Balasore. This storm was very small, of very slight intensity, and of no importance.

6. Storm of the 23rd to the 26th of August. This was generated further to the south than the preceding storm, and crossed the Ganjam coast between Gopalpore and Vizagapatam on the evening of the 25th. It was of slight intensity.

7. Storm of the 30th August to the 3rd. of September. This depression crossed the coast near Balasore on the afternoon of the 2nd of September, and was of moderate intensity.

8. Storm of the 6th and 7th of September. This was formed immediately after the preceding, and followed along nearly the same track, crossing the Orissa coast to the south of Balasore on the morning of the 7th. It was of small intensity.

9. Storm of the 11th to the 15th of November. This was generated in the Martaban Gulf, and advanced in a north-westerly direction as far as Lat.  $16^{\circ}$  N. Long.  $93^{\circ}$  E. to the west of Diamond Island, when it recurved and moved northwards parallel to the coast, breaking up in the neighbourhood of Akyab during the afternoon of the 14th. This was the most severe and intense storm of the year in the Bay, but was

of very limited extent, and hence did not affect the weather in the north-west angle of the Bay.

10. Storm of the 2nd to the 4th of December, which gave heavy rain at a very unusual time of the year to Bengal.

Two of these were remarkable for the length of time that elapsed before they broke up after they had crossed the Bengal or Orissa coast, and also for the very heavy rainfall and floods which accompanied their existence on land. The first of these was the storm of June 13th to 20th which was formed in the immediate neighbourhood of the Balasora coast. It drifted through Chittia Nagpur and South Behar into North Behar and gave excessively heavy rain to a narrow area in Behar stretching from Gya to Motihari and Durbhunga. This storm was of little importance at sea.

The second storm of the series was similar in its general character. It was generated near the Head of the Bay, crossed the North Orissa coast, and advanced over the Orissa Hills into the Central Provinces. Instead of breaking up as do three out of four storms or cyclonic circulations which pass from the Bay into the Central Provinces, it acquired fresh energy and drew large supplies of vapour from the Bombay monsoon current. It advanced across the head of the Peninsula almost parallel to the valleys of the Nerbudda and Tapti. The heavy rain accompanying it caused excessive floods in these two rivers which inflicted much damage on the town of Surat, and others in the lower portion of the valleys of these two rivers. This cyclonic circulation apparently broke up in the Arabian Sea in the immediate neighbourhood of the Guzerat and Sind coasts.

The meteorology of India for the year 1883 was remarkable in several respects. One or two of the more important features had a direct bearing on the number and character of the cyclones.

During the cold weather months several storms of unusual character and magnitude passed over Northern India and the Himalayas from west to east. They gave excessive snowfall over the higher Himalayas and affected the weather certainly for many weeks and probably more or less permanently for the year. The accumulation of snow reduced temperature for some time and gave a strong northerly element to the air motion or wind circulation over Northern India. The south-west monsoon set in about the normal period on the Burmah and Bengal coasts, but it never obtained its usual hold in Northern India. The rains were irregular in occurrence and distribution, and much below the average over the whole of Northern India. The deficiency was quite as marked in North Bengal as in North Behar or Rohilkhand or in the Western districts of the Punjab. The monsoon was in ordinary language very weak, and

its weakness was more especially shown in Bengal by the early and complete termination of the rains in the last week of September.

The only theory which on the whole explains the phenomena of cyclonic generation and motion, *viz.*, the condensation theory, indicates that small cyclonic storms should be of frequent occurrence during the south-west monsoon, and that they should be most frequent when the monsoon is weak on land, or in other words, when the rainfall occurs to a smaller extent over the land and therefore usually to a greater extent over the sea area in the neighbourhood of the land. The rainfall in the Bay near the Burmah, Arracan, and Bengal coasts during the south-west monsoon of 1883 was, according to the various accounts received in the Meteorological Office, noticeably larger in amount than usual. The large number of cyclonic storms which formed during the period the south-west monsoon prevailed in Northern India in the year 1883 confirms this inference from theory.

After the south-west monsoon current finally retreated from Northern India in the last week of September, it recurved as usual over the Bay. The moisture brought up by it was, however, at once discharged on the Madras coast districts. The condensation theory indicates that there is a marked tendency during the transition period of October and November to the commencement and continuance of heavy rainfall over the centre of the Bay, and therefore to the generation of severe cyclonic storms at that period. If, however, the aqueous vapour or moisture is not discharged as rain over the Bay, but is carried westwards by the north-east monsoon winds and deposited on and near the Madras coast, the conditions for the formation of a cyclonic storm are not present in the Bay. In other words, if heavy general rain sets in and continues over the Madras coast at the change of this monsoon, the Bay will be free from severe and extensive storms. This rule was strikingly illustrated by the weather of the Bay and the Madras coast in October and November 1883.

The paper will deal with the subject under the following heads:—

1. History of the Storm of June 26th to July 4th.
2. Discussion of the more important features of the Storm of 26th June to 4th July.
3. History of the Storm of 10th to 15th November.
4. Discussion of the more important features and peculiarities of the Storm of 10th to 15th November.
5. General remarks on the generation of cyclones.

## CHAPTER II.

## HISTORY OF THE STORM OF JUNE 26TH TO JULY 4TH.

The south-west monsoon set in slightly earlier than usual on the Bengal coast in 1883, but with no great strength. Moderate rain fell over the whole of the Province of Bengal during the first fortnight. On the 12th there began to form, in the north-west angle of the Bay, between False-point and Saugor Island, and over the adjacent portion of south-west Bengal, a small barometric depression; and on the morning of the 13th, the winds in South-west Bengal and North Orissa indicated cyclonic convergence to it. The depression intensified on the 14th, and its centre was then to the north of and in the neighbourhood of Balasore. It advanced northwards through Chutia Nagpore and South Behar across the Ganges into the central districts of North Behar, and gave excessive rain over a narrow area stretching from Gya through Behar and Patna to Mozufferpore and Durbhunga. Amongst the remarkable rainfalls were the following :—

|                    | 15th | 16th | 17th  | 18th | 19th |
|--------------------|------|------|-------|------|------|
| Gya .....          | 1·01 | 9·04 | 0·21  | 0·01 | nil. |
| Behar .....        | 5·17 | 6·05 | 10·95 | 0·58 | 0·09 |
| Patna .....        | 1·23 | 6·35 | 5·13  | nil. | 0·05 |
| Mozufferpore ..... | 0·08 | 2·85 | 12·49 | 0·42 | nil. |
| Hajipur .....      | 0·86 | 4·51 | 9·39  | nil. | 0·14 |
| Durbhunga .....    | 0·53 | 1·02 | 5·02  | 8·52 | 0·24 |

The disturbance broke up in North Behar and finally disappeared on the 20th. During the next five days there was a partial break in the rains. The air was drier, sky less clouded, and rain showers local rather than general in character. The winds more especially diminished in strength, but continued to indicate the same general atmospheric motion over the Gangetic delta and valley as before. Southerly winds blew across the Bengal coast. In Northern Bengal and Behar the current was deflected up the Gangetic valley and hence gave winds blowing from directions varying generally between N. E. and S. E. In Chutia Nagpore and in Western Orissa the effects of the Bombay branch of the monsoon current were beginning to be shown by the prevalence of moist S. S. W. winds at Hazarabagh and of W. N. W.

winds at Cuttack. The Bombay branch of the monsoon current, it may be added, was late in being established on the Bombay coast, and was very feeble before the 20th of the month, when it rapidly increased in force, as measured by the strength of the winds.

The heavy rainfall attending the disturbance of the third week of the month had drained the southerly monsoon winds advancing into Bengal from the Bay of a very large portion of their moisture, and weakened them for some days. This is shown by the diminution in the amount of the rainfall and by the decreased velocity of the winds in Bengal.

The following table gives the average amount of the rainfall day by day between the 13th and the 26th in the various divisions in Bengal, and illustrates fully the general diminution in the rainfall of every part of the Province after the 20th :—

*Table of Average Rainfall recorded in Bengal, June 13th to 26th 1883.*

| PROVINCE.                                  | No. of Stations. | 13th. | 14th. | 15th. | 16th. | 17th. | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. | 26th. |
|--------------------------------------------|------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Orissa. ....                               | 16               | 0.64  | 1.30  | 0.23  | 0.04  | 0.25  | 0.16  | 0.30  | 0.09  | Nil.  | 0.37  | 0.10  | 0.43  | 0.10  | 0.41  |
| S. W. Bengal                               | 46               | 0.31  | 0.78  | 0.12  | 0.26  | 0.27  | 0.26  | 1.02  | 0.31  | 0.66  | 0.26  | 0.45  | 0.10  | 0.18  | 0.07  |
| East Bengal                                | 26               | 0.18  | 0.51  | 1.62  | 1.11  | 0.86  | 1.00  | 1.48  | 0.46  | 0.82  | 0.33  | 0.17  | 0.18  | 0.16  | 0.11  |
| North Bengal                               | 27               | 0.09  | 0.21  | 0.91  | 1.79  | 1.71  | 0.47  | 1.23  | 2.25  | 0.97  | 0.33  | 0.72  | 1.09  | 0.98  | 0.96  |
| North Behar                                | 16               | 0.04  | 0.12  | 0.52  | 1.86  | 3.69  | 1.36  | 1.13  | 1.21  | 0.42  | 0.42  | 0.30  | 0.07  | 1.98  | 0.89  |
| South Behar                                | 17               | 0.29  | 0.08  | 1.40  | 3.37  | 1.99  | 0.92  | 0.35  | 0.11  | 0.04  | 0.09  | 0.38  | Nil.  | 0.38  | 0.77  |
| Chutia Nag-<br>pore & Son-<br>thal Perg. } | 16               | 0.30  | 0.50  | 2.04  | 0.48  | 0.21  | 0.56  | 0.63  | 0.97  | 0.15  | 0.37  | 0.13  | Nil.  | 0.19  | 0.35  |

The following table gives the daily amounts of wind for the same period at the chief Meteorological Stations in Orissa, Bengal, and Behar.

*Table of Daily Amount of Wind at eight Stations in Bengal,  
June 13th to 25th, 1883.*

|                 | 13th. | 14th. | 15th. | 16th. | 17th. | 18th. | 19th. | 20th. | 21st. | 22nd. | 23rd. | 24th. | 25th. | Average Daily<br>Amount, June. |
|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------------------|
| False Point ... | 261   | 207   | 326   | 258   | 265   | 207   | 270   | 241   | 245   | 244   | ?     | 285   | 298   | 240                            |
| Calcutta .....  | 127   | 141   | 166   | 215   | 177   | 140   | 167   | 178   | 166   | 151   | 122   | 72    | 104   | 162                            |
| Dacca .....     | 102   | 174   | 161   | 171   | 177   | 160   | 193   | 229   | 217   | 211   | 181   | 142   | 155   | 186                            |
| Dinagepore ...  | 144   | 168   | 312   | 261   | 216   | 144   | 192   | 216   | 144   | 120   | 120   | 144   | 120   | ?                              |
| Purneah .....   | 76    | 100   | 170   | 111   | 126   | 114   | 255   | 158   | 24    | 26    | 21    | 47    | 29    | 98                             |
| Durbhunga ..    | 137   | 185   | 279   | 148   | 278   | 153   | 58    | 74    | 127   | 57    | 59    | 116   | 134   | 137                            |
| Patna .....     | 117   | 148   | 206   | 251   | 114   | 58    | 60    | 121   | 138   | 55    | 111   | 107   | 127   | ?                              |
| Hazaribagh ..   | 99    | 134   | 191   | 286   | 329   | 182   | 206   | 153   | 239   | 136   | 211   | 182   | 178   | 214                            |

The rainfall table shews a very marked diminution in the amount of rain after the 20th. An examination of the complete rainfall returns of the Province of Bengal indicates that it occurred as isolated and local showers, which were occasionally heavy and gave large amounts at single stations. No general rain, however, fell over any considerable portion of the Province between the 20th and 25th. Similarly, an examination of the second table giving wind amounts indicates that, although strong winds generally prevailed between the 13th and 20th, winds were unusually light after the 20th and below their normal strength. This feature of weakness of its air motion was most markedly shown by the stations most distant from the sea, as, for example, Purneah.

The meteorological observations taken in Bengal thus show that what may be termed a strong monsoon prevailed at the Head of the Bay and in Bengal from the 1st to the 20th of the month, and that for some days afterwards, or between the 20th and the 25th, it was much feebler. Also, as will be seen from the following observations and from the history of the storm, the south-west monsoon winds increased in force to the west of the Andamans on the 23rd, advanced northwards as a strong atmospheric current along the coasts of Burmah and Arracan, and fed the cyclonic vortex which formed on the 26th and 27th with large supplies of aqueous vapour.



*Table of Daily Amount of Wind at seven Stations to the east of the Bay.  
July 22nd to 28th, 1883.*

|                    | Average<br>June. | 22nd. | 23rd. | 24th. | 25th. | 26th. | 27th. |       |
|--------------------|------------------|-------|-------|-------|-------|-------|-------|-------|
| Nancowry . . .     | 263.5            | 115.0 | 98.8  | 97.3  | 124.2 | 252.7 | 354.5 | 289.8 |
| Port Blair . . .   | 257.6            | 128.7 | 212.9 | 386.0 | 283.8 | 305.4 | 315.6 | 323.0 |
| Diamond Island     | 203.0            | 122.9 | 118.5 | 118.7 | 210.7 | 310.4 | 346.6 | 336.5 |
| Akyab . . .        | 93.6             | 42.7  | 48.9  | 55.1  | 83.6  | 100.9 | 153.8 | 234.4 |
| Chittagong . . . . | 168.3            | 162.6 | 113.5 | 2.9   | 71.9  | 50.1  | 117.7 | 212.2 |
| Sangor Island . .  | 332.4            | 362.7 | 312.4 | 284.7 | 235.2 | 144.5 | 137.1 | 357.4 |
| Dacca . . . . .    | 183.7            | 211.1 | 181.1 | 112.8 | 155.0 | 68.8  | 66.8  | 181.1 |

The preceding table shows that on the 22nd and 23rd the winds were barely half their normal strength over the east of the Bay. A rapid increase took place on the 24th at Port Blair, which extended to Diamond Island on the 25th and to Akyab and Chittagong on the 26th and 27th.

These figures suggest what is also indicated by the whole of the Bengal observations, *viz.*, that the weather in the Bay between the 20th and 23rd of June was that which usually accompanies the commencement of a partial break in the rains in Bengal or Northern India. Winds were light and unsteady over the whole of the north and centre of the Bay. The logs of vessels show that occasional rain-squalls local in character occurred, more especially in the south of the Bay. The observations at Port Blair, Nancowry, Diamond Island, and Akyab and of the ships traversing the Bay at the time, however, prove conclusively that south-westerly winds prevailed over the whole of the Bay; and the Bengal observations establish that they were continued in Bengal and Behar as southerly and easterly winds. They also indicate that on the 24th a change occurred in the character of the winds to the west of the Andamans which lasted for some days. A very considerable increase occurred in the south-west winds of that part of the Bay which rapidly and steadily extended northwards.

Hence prior to the morning of the 25th the gradients were normal in direction, although smaller in amount than the average for the season, over the Bay; the winds blew from the usual quarter and gave rise to the normal atmospheric current up the Gangetic valley. The only indication afforded at this time by the land observations of the subsequent stormy weather was the occurrence of a partial break in the rains, which, as has been ascertained by previous experience, establishes conditions which are favourable to the development of a cyclonic disturbance if an adequate motive power or disturbance act on the atmosphere.

The account of the storm of the last week of June hence begins with the 25th of June, the day before which there were any indications of the actual formation of an atmospheric whirl at the Head of the Bay.

25th of June.—The atmosphere was in a slightly disturbed state over nearly the whole of India. The barometer was rising in the North-Western Provinces, Bengal, and the south of the Peninsula, but elsewhere it was falling. A large depression accompanying the establishment of the south-west monsoon in Western India was advancing along the west coast of India and causing the barometer to fall quickly. Winds had backed to south-east on the 24th at Bombay. On the 25th, winds were southerly along the Bombay coast and easterly in Cutch. There were strong indications that gales of considerable force were blowing on and near the Bombay coast. The weather was cloudy everywhere, except in the Punjab; and rain in small or moderate amounts was falling in every part of India, except the Punjab, Behar, Sind, and parts of the Madras Presidency. The rainfall was very small in amount and local in its distribution over the North-Western Provinces, Bengal, Rajputana, and the North Bombay districts.

The following table gives the more important observations taken at the Coast Stations on the Bay of Bengal on the 25th June, 1883:—

| STATIONS.                | 10 A. M.<br>Barometer reduced to sea level. | Change since 10 A. M. 24th. | Wind direction. |          | Wind velocity of previous 24 hours miles per hour. | Percentage of wind amount to average. | Cloud 10 A. M. | Rainfall of previous 24 hours. |
|--------------------------|---------------------------------------------|-----------------------------|-----------------|----------|----------------------------------------------------|---------------------------------------|----------------|--------------------------------|
|                          |                                             |                             | 10 h.           | 16 h.    |                                                    |                                       |                |                                |
| Nancowry .....           | 29.941                                      | + .047                      | S. S. W.        | S. S. W. | 5                                                  | 45                                    | 8              | 0.14                           |
| Port Blair .....         | 29.911                                      | + .069                      | S. W.           | S. W.    | 14                                                 | 127                                   | 10             | 1.05                           |
| Diamond Island           | 29.847                                      | + .024                      | S. W.           | W. S. W. | 8                                                  | 100                                   | 9              | 0.24                           |
| Akyab .....              | 29.792                                      | + .019                      | E. S. E.        | S.       | 4                                                  | 100                                   | 9              | 1.35                           |
| Chittagong ...           | 29.802                                      | + .027                      | S. E.           | S. W.    | 3                                                  | 43                                    | 10             | 0.15                           |
| Dacca .....              | 29.752                                      | + .024                      | S.              | S. E.    | 7                                                  | 88                                    | 10             | ...                            |
| Jessore .....            | 29.745                                      | + .040                      | calm.           | S. S. W. | 7                                                  | 140                                   | 8              | ...                            |
| Calcutta (Alipore) ..... | 29.719                                      | + .025                      | S.              | S. S. W. | 5                                                  | 83                                    | 9              | 0.05                           |
| Saugor Island            | 29.775                                      | + .053                      | S.              | S. S. E. | 31                                                 | 221                                   | 3              | 0.21                           |
| Balasore ...             | 29.715                                      | + .010                      | S. W.           | ?        | 5                                                  | ?                                     | 3              | ...                            |

| STATIONS.       | 10 A. M.<br>Barometer reduc-<br>ed to sea level. | Change since<br>10 A. M. 24th. | Wind direction. |          | Wind velocity of<br>previous 24 hours<br>miles per hour. | Percentage of<br>wind amount to<br>average. | Cloud<br>10 A. M. | Rainfall<br>of<br>previous<br>24 hours. |
|-----------------|--------------------------------------------------|--------------------------------|-----------------|----------|----------------------------------------------------------|---------------------------------------------|-------------------|-----------------------------------------|
|                 |                                                  |                                | 10 h.           | 16 h.    |                                                          |                                             |                   |                                         |
| Cuttack.....    | 29.695                                           | + .015                         | W. S. W.        | S.       | 3                                                        | 75                                          | 9                 | 1.01                                    |
| False Point ... | 29.722                                           | + .005                         | Calm.           | E.       | 11                                                       | 110                                         | 8                 | 0.03                                    |
| Vizagapatam     | 29.672                                           | — .027                         | W.              | W. by S. | 6                                                        | 150                                         | 8                 | ...                                     |

Pressure had increased rather rapidly over the province of Bengal during the previous 24 hours. The general result of the changes of pressure since the dispersion of the disturbance of the third week of the month had been to give a high barometer, which culminated on the morning of the 25th in excessively high readings. The barometric readings at 10 A. M. of that day in Bengal were above the average by amounts which varied from .19" at Saugor Island to .09" at Durbhunga. Winds were, however, generally normal in direction, blowing from south in South-West Bengal, south-east in East Bengal, east in North and Central Behar, and south-west in Chutia Nagpore.

The unusual weakness of the wind is shown by the following comparison table:—

|                | Wind amount<br>of 24 hours<br>preceding<br>10 A. M. | Average<br>daily wind<br>amount June. | Percentage<br>of actual to<br>average wind<br>amount. |
|----------------|-----------------------------------------------------|---------------------------------------|-------------------------------------------------------|
| Saugor Island  | 256.9                                               | 332.4                                 | 77.3                                                  |
| Calcutta.....  | 104.0                                               | 152.3                                 | 68.3                                                  |
| Berhampore ..  | 132.6                                               | 132.3                                 | 100.2                                                 |
| Dacca.....     | 162.1                                               | 183.7                                 | 88.3                                                  |
| Jessore .....  | 118.3                                               | 118.3                                 | 100.0                                                 |
| Chittagong ..  | 71.5                                                | 168.3                                 | 42.5                                                  |
| Burdwan .....  | 110.7                                               | 124.2                                 | 89.1                                                  |
| Cuttack .....  | 40.0                                                | 96.3                                  | 41.5                                                  |
| False Point .. | 263.3                                               | 247.2                                 | 106.5                                                 |

The average rainfall in each of the seven meteorological divisions of Bengal for the 24 hours preceding 6 P. M. of the 25th June is given in page 58.

The following table gives the meteorological information for the 25th extracted from the logs of vessels:—

| Vessel.     | Hour.   | Latitude.          | Longitude. | Probable reduced barometer. | Wind.    |        | REMARKS.                                                                   |
|-------------|---------|--------------------|------------|-----------------------------|----------|--------|----------------------------------------------------------------------------|
|             |         |                    |            |                             | Dir.     | Force. |                                                                            |
| Bancoora    | 4 A. M. |                    |            | 29.899                      | S. S. W. | 3      | 8 A. M. Light breeze and hazy.                                             |
|             | 8 A. M. |                    |            | 30.988                      | N. E.    | 2      | 11 A. M. Heavy rain squall.                                                |
|             | Noon    | N. 5° 58' by D. R. | E. 80° 58' | .963                        | W. S. W. | 3      | Noon. Moderate breeze and fine.                                            |
|             | 4 P. M. |                    |            | 29.889                      | S. W.    | 3      |                                                                            |
|             | 8 P. M. |                    |            | .901                        | S. W.    | 3      |                                                                            |
|             | Midnt.  |                    |            | .889                        | S. W.    | 3      | Midnight. Moderate breeze and clear.                                       |
| India ..... | 4 A. M. |                    |            |                             | S.       | 4      | Moderate breeze with passing squalls.                                      |
|             | 8 A. M. |                    |            | 29.750                      | N. W.    | 3      | Breeze moderating and fine.                                                |
|             | Noon    | N. 15° 10'         | E. 83° 14' | .730                        | W.       | 3      | Moderate breeze and fine.                                                  |
|             | 4 P. M. |                    |            |                             | W.       |        | Moderate fresh wind; cloudy with showers.                                  |
|             | 8 P. M. |                    |            | .730                        | W.       | 4      | Fresh breeze and overcast.                                                 |
|             | Midnt.  |                    |            | .730                        | W.       | 3      | Threatening to N.W. with lightning.                                        |
| Himalaya    | 4 A. M. |                    |            | 29.712                      | S. S. W. |        |                                                                            |
|             | 8 A. M. |                    |            | .747                        | W. S. W. |        |                                                                            |
|             | Noon.   | N. 15° 13'         | E. 82° 29' | .737                        | S. W.    | 3      | Moderate breeze and overcast.                                              |
|             | 4 P. M. |                    |            | .731                        | W. S. W. |        |                                                                            |
|             | 8 P. M. |                    |            | .734                        | S. W.    |        |                                                                            |
|             | Midnt.  |                    |            | .757                        | S. W.    |        |                                                                            |
| Roma .....  | 4 A. M. |                    |            |                             | S. W.    | 5      | Fresh breeze and moderate sea.                                             |
|             | 8 A. M. |                    |            |                             | ...      | ...    |                                                                            |
|             | Noon    | N. 17° 15'         | E. 85° 17' |                             | ...      | 0 to 3 | Moderate variable wind with very heavy rain squalls and dark overcast sky. |
|             | 4 P. M. |                    |            |                             | ...      | 4      | Rain squalls.                                                              |
|             | 8 P. M. |                    |            |                             | ...      | ...    | Lightning, similar weather and high S. S. W. sea.                          |
|             | Midnt.  |                    |            |                             | ...      | ...    | Overcast sky.                                                              |

| Vessel.             | Hour.   | Latitude. | Longitude. | Probable reduced barometer. | Wind.    |        | REMARKS.                                                                                                         |
|---------------------|---------|-----------|------------|-----------------------------|----------|--------|------------------------------------------------------------------------------------------------------------------|
|                     |         |           |            |                             | Dir.     | Force. |                                                                                                                  |
| Saint Magnus        | 4 A. M. |           |            | 29.690                      | W. S. W. | 4      |                                                                                                                  |
|                     | 8 A. M. | N.        | E.         | .700                        | S. W.    | 4      |                                                                                                                  |
|                     | Noon    | 18° 31'   | 86° 29'    | .710                        | W.       | 1      |                                                                                                                  |
|                     | 4 P. M. |           |            | .680                        | S.       | 1      | Calms and rain.                                                                                                  |
|                     | 8 P. M. |           |            | .710                        | S. W.    | 5      | Cloudy, lightning to S. W. & S. E.                                                                               |
| Star of Albion      | 4 A. M. |           |            | 29.730                      |          |        |                                                                                                                  |
|                     | 8 A. M. | N.        | E.         | .740                        |          |        | Easterly current.                                                                                                |
|                     | Noon    | 18° 46'   | 86° 40'    | .740                        | W.       | 4 to 5 | Squally.                                                                                                         |
|                     | 4 P. M. |           |            | .710                        |          |        | Cloudy weather.                                                                                                  |
|                     | 8 P. M. |           |            | .720                        |          |        |                                                                                                                  |
| Scottish Chief-tain | 8 A. M. |           |            | 29.680                      |          | 0      | Very light airs and dark cloudy weather.                                                                         |
|                     | Noon    | N.        | E.         |                             |          |        |                                                                                                                  |
|                     | 4 P. M. | 18° 58'   | 86° 34'    | .690                        | S. by W. | 1      |                                                                                                                  |
|                     | 8 P. M. |           |            | .660                        | S. W.    | 2      | Strong westerly current.                                                                                         |
| British Princess    | 4 A. M. |           |            |                             | S. by W. | 5      | Cloudy sky and S. W. swell.                                                                                      |
|                     | 8 A. M. |           |            |                             | S. W.    | 4      | Variable winds.                                                                                                  |
|                     | Noon    | N.        | E.         |                             |          |        |                                                                                                                  |
|                     | 4 P. M. | 19° 9'    | 85° 15'    | 29.700                      | E.       | 2      | Fine clear weather.                                                                                              |
|                     | 8 P. M. |           |            |                             | E. S. E. | 4      | Squally with rain.                                                                                               |
|                     | Midnt.  |           |            |                             | S.       | 3      | Cloudy sky.                                                                                                      |
| Prince Amadeo       |         |           |            |                             | W. S. W. | 4      | S. W. swell moderating.                                                                                          |
|                     |         |           |            |                             | S. S. E. |        | Midnight.                                                                                                        |
|                     | 4 A. M. |           |            |                             | S. W.    | 4      | A. M. Weather clearing, wind moderate. 4 A. M. Gentle wind, fine weather. Noon. Closesultry weather. Sea smooth. |
|                     | Noon    | N.        | E.         |                             |          |        |                                                                                                                  |
| Commilla .....      | 4 P. M. | 19° 23'   | 85° 56'    | 29.700                      | S.       | 4      |                                                                                                                  |
|                     |         |           |            |                             |          |        |                                                                                                                  |
|                     | 4 P. M. |           |            |                             | E. S. E. | 3      | 4 P. M. Weather fine Sea very smooth.                                                                            |
|                     |         |           |            |                             |          |        |                                                                                                                  |
| Commilla .....      | 8 A. M. |           |            |                             | Variable | 2      | Showery.                                                                                                         |
|                     | Noon    | N.        | E.         |                             |          |        |                                                                                                                  |
|                     |         | 20° 13'   | 92° 28'    |                             | S. E.    | 3      | Clear weather and smooth sea.                                                                                    |
|                     | 4 P. M. |           |            | 29.611                      | S. S. E. | 3      | Fine weather.                                                                                                    |
|                     | 8 P. M. |           |            | .683                        | S. E.    | 4      | Fine weather and lightning to eastward.                                                                          |
|                     | Midnt.  |           |            | .671                        | E. S. E. | 4      | Clear weather and smooth sea.                                                                                    |

The logs of the vessels received in the Meteorological office give an imperfect view of the weather in the Bay, as they were chiefly those of steamers passing up to Calcutta along the west coast of the Bay.

The Bancoora rounding Ceylon had light to moderate south-west breezes (force 1 to 3) during the day. The India and Himalaya were a few miles apart off the coast to the south-east of Coconada. The former was in Lat.  $15^{\circ} 10'$  N. and Long.  $83^{\circ} 14'$  E. at noon and the latter in Lat.  $15^{\circ} 13'$  N. and Long.  $82^{\circ} 29'$  E. Both had moderate breezes and overcast skies. The winds were of force 3 and from directions between W. and S. W. The Roma, in Lat.  $17^{\circ} 15'$  N. and Long.  $85^{\circ} 17'$  E. at noon, had moderate variable winds with calms and very heavy rain squalls. The Star of Albion, Scottish Chieftain, and Saint Magnus were all near each other off the Gopalpore coast. The winds were very light and unsteady, but were generally from directions between west and south-west. The Scottish Chieftain had calms at 8 A. M., and the Saint Magnus calms and rain at 4 P. M. The British Princess and Prince Amadeo were a little further to the north. The former, in Lat.  $19^{\circ} 9'$  N. and Long.  $85^{\circ} 15'$  E. at noon, had variable winds during the day varying in force between 2 and 5. The latter, in Lat.  $19^{\circ} 23'$  N. and Long.  $86^{\circ} 56'$  E., had gentle south-west winds, sultry weather, and a smooth sea. There were hence no indications on this day of the existence of an atmospheric whirl in the Bay.

*26th June.*—During the previous 24 hours the barometer had risen rapidly at the Bombay stations, and the depression off that coast was much less marked than on the 25th at Bombay and the adjacent coast stations. South-westerly gales were blowing, but the rainfall brought up by them was as yet moderate in amount. In parts of Southern and Central India the barometer had also risen, but over the whole of Northern India a considerable fall had taken place. Along the foot of the hills, from Assam to the Punjab, the wind was generally easterly or north-easterly, and in the Central Provinces and Central India it was westerly. The weather was dull and sky overcast over the whole country except the Punjab, and rain was falling except in North-Western and Central India, but the amounts registered were in the great majority of cases small. The rainfall returns, as compared with the average rainfall between June 1st and 26th, shew that there was a deficiency of from 1 to 3 inches over the plains of the Punjab, the western half of the North-Western Provinces, Central India, and Rajputana, and of 7 inches in Bombay.

The following are the more important observations taken at 10 A. M. of the 26th at the selected stations near the Head of the Bay :—

| STATIONS.          | 0 A. M. Barometer reduced to sea level. | Change since 0 A. M. 25 | Wind.    |          | Average wind velocity of previous 24 hours. | Cloud 0 A. M. | Rainfall of previous 24 hours |
|--------------------|-----------------------------------------|-------------------------|----------|----------|---------------------------------------------|---------------|-------------------------------|
|                    |                                         |                         | 10 h.    | 16 h.    |                                             |               |                               |
| Nancowry .....     | 29·915                                  | —·026                   | S. W.    | S. W.    | 11                                          | 100           | 7                             |
| Port Blair .....   | 29·886                                  | —·025                   | S. W.    | S. W.    | 11                                          | 100           | 10 0·32                       |
| Diamond Island..   | 29·801                                  | —·046                   | S.       | S. W.    | 10                                          | 125           | 8 1·26                        |
| Akyab.....         | 29·711                                  | —·081                   | S. E.    | S. S. E. | 4                                           | 100           | 9 1·98                        |
| Chittagong.....    | 29·660                                  | —·142                   | S. E.    | E.       | 2                                           | 29            | 5 0·01                        |
| Dacca .....        | 29·682                                  | ·070                    | S.       | S. E.    | 6                                           | 75            | 9 1·67                        |
| Jessore .....      | 29·673                                  | ·072                    | S.       | S.       | 6                                           | 120           | 10 0·04                       |
| Calcutta (Alipore) | 29·646                                  | ·073                    | E. S. E. | E. by S. | 3                                           | 50            | 8 0·71                        |
| Saugor Island ...  | 29·647                                  | —·128                   | S. E.    | E. S. E. | 7                                           | 50            | 2 0·08                        |
| Balasore .....     | 29·636                                  | —·07?                   | N. N. E. | ?        | 2                                           | ?             | 6 ...                         |
| Cuttack .....      | 29·626                                  | —·069                   | S. S. W. | Calm.    | 1                                           | 25            | 9 0·12                        |
| False Point. ....  | 29·621                                  | —·101                   | N. E.    | E.       | 8                                           | 80            | 4 ...                         |
| Vizagapatam .....  | 29·668                                  | —·004                   | W.       | W.       | 5                                           | 125           | 6 0·10                        |

Pressure, it will be seen from the above, had given way, and the fall was greatest at Saugor Island and Chittagong. This was due, as shewn by the wind directions, to the formation of an area of cyclonic disturbance and barometric depression near the Head of the Bay. The winds at Saugor Island had shifted to south-east, at False Point to north-east, and at Gopalpore to north-west. From the information extracted from the logs, it will be seen that light north-east winds were established over a considerable portion of the north-west of the Bay. Hence, the cyclonic circulation was just beginning to affect the direction of air motion at Saugor Island and was causing it to back. It was, however, not yet participating directly in the cyclonic indraught. The sky was more or less clouded in all parts of the province of Bengal, the air very damp (especially in Behar, after the floods of the previous week), and winds unusually light and somewhat unsteady.

The following table gives the average rainfall in the seven divisions of the province of Bengal for the 24 hours preceding 6 P. M. :—

Table of Average Rainfall in Bengal on the 26th June 1883:

| Name of Province.            | Average Rain. |
|------------------------------|---------------|
| Orissa .....                 | 0.41          |
| South West Bengal.....       | 0.07          |
| East Bengal .....            | 0.11          |
| North Bengal .....           | 0.96          |
| North Behar.....             | 0.89          |
| South Behar.....             | 0.77          |
| Sonthal Pergannahs and ..... | } 0.35        |
| Chutia Nagpore .....         |               |

The following extracts from the logs of vessels give information respecting the Bay on the 26th :—

| Vessel.        | Hour.   | Latitude.  | Longitude. | Probable reduced barometer. | Wind.           |        | REMARKS.                                                               |
|----------------|---------|------------|------------|-----------------------------|-----------------|--------|------------------------------------------------------------------------|
|                |         |            |            |                             | Dir.            | Force. |                                                                        |
| Bancoora       | 4 A. M. |            |            | 29.876                      | SW. by S.       | 2      | 4 A. M. Light breeze and fine.                                         |
|                | 8 A. M. |            |            | .883                        | SW. by S.       | 2      | 8 A. M. Light following wind and clear.                                |
|                | Noon    | N. 8° 35'  | E. 82° 35' | .863                        | S. W. by S.     | 2      |                                                                        |
|                | 4 P. M. |            |            | .780                        | W S. W.         | 2      |                                                                        |
|                | 8 P. M. |            |            | .856                        | S. S. W.        | 2      |                                                                        |
|                | Midnt.  |            |            | .816                        | S. S. W.        | 3      | Evening. Moderate breeze and fine.                                     |
| Pomba ...      | Noon    | N. 16° 46' | E. 96° 12' |                             |                 |        | 10 A. M. At Rangoon.                                                   |
|                | 4 P. M. |            |            |                             | S. W.           | 5      | Unmoored and proceeded towards Calcutta.                               |
|                | Midnt.  |            |            | 29.750                      | ...             | 5      | Midnight. Fresh to moderate breezes and frequent rain squalls.         |
| Himalaya       | 4 A. M. |            |            | 29.657                      | W.              |        |                                                                        |
|                | 8 A. M. |            |            | .635                        | W.              |        |                                                                        |
|                | Noon    | N. 17° 32' | E. 84° 38' | .615                        | W.              |        | Moderate breeze and overcast.                                          |
|                | 4 P. M. |            |            | .506                        | S. W.           |        |                                                                        |
|                | 8 P. M. |            |            | .586                        | W. S. W.        |        | Moderate breeze and fine.                                              |
|                | Midnt.  |            |            | .539                        | W. S. W.        |        |                                                                        |
| Star of Albion | 8 A. M. | N. 19° 21' | E. 86° 20' | 29.700                      |                 |        | Principally light unsteady winds, finer at night than in the day time. |
|                | Noon    |            |            | .630                        | W. to SW & N. W | 4 to 2 |                                                                        |
|                | 4 P. M. |            |            | .620                        |                 |        |                                                                        |



| Vessel.               | H <sup>o</sup> | Longi           | Probab.<br>reduce<br>anomet | Wind.             |         | REMARKS.                                                                                                                                                                                                                        |
|-----------------------|----------------|-----------------|-----------------------------|-------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |                |                 |                             | Dir.              | Force.  |                                                                                                                                                                                                                                 |
| British Prin-<br>cess | 4 A. M.        |                 |                             | W. S. W.          | 4       | Dark cloudy sky.                                                                                                                                                                                                                |
|                       | 8 A. M.        |                 |                             | W. N. W.          | 3       | Light green sky.                                                                                                                                                                                                                |
|                       |                | N. E.           |                             |                   |         |                                                                                                                                                                                                                                 |
|                       | Noon           | 19° 30' 87° 3'  | 29° 600'                    | N. N. E.          | 4       | Weather fine and clear<br>with S. W. swell.                                                                                                                                                                                     |
|                       | 4 P. M.        |                 |                             | E. N. E.          | 3       |                                                                                                                                                                                                                                 |
|                       | 8 P. M.        |                 |                             | E                 | 0 to 3  | High southerly swell<br>and cloudy, the stars<br>showing with great<br>brilliancy.                                                                                                                                              |
|                       | Midnt          |                 |                             | W. N. W.          | 5       |                                                                                                                                                                                                                                 |
| India                 | A. M.          |                 |                             | W.                |         | Strong winds & squally<br>with clouds.                                                                                                                                                                                          |
|                       | 8 A. M.        |                 | 29° 610'                    | N. by E           |         | Moderating breezes and<br>cloudy weather.                                                                                                                                                                                       |
|                       |                | N. E.           |                             |                   |         |                                                                                                                                                                                                                                 |
|                       | Noon           | 19° 30' 86° 33' | 630'                        | ...               |         | Moderate breeze and<br>cloudy.                                                                                                                                                                                                  |
|                       | 4 P. M.        |                 | 630'                        | N. E.             |         | Moderate breeze, fine.                                                                                                                                                                                                          |
|                       | 8 P. M.        |                 | 590'                        | Calm.             |         | Calm and clear.                                                                                                                                                                                                                 |
|                       | Midnt          |                 | 580'                        | N. E.             |         | Moderate breeze with<br>passing clouds.                                                                                                                                                                                         |
| Saint Mag-<br>nus     | 4 A. M.        |                 | 29° 610'                    | W.                |         | Cloudy weather.                                                                                                                                                                                                                 |
|                       | 8 A. M.        | N. E.           | 610'                        | N.                |         |                                                                                                                                                                                                                                 |
|                       | Noon           | 19° 47' 87° 18' | 600'                        | N. E.             |         | Faint airs and calms.                                                                                                                                                                                                           |
|                       | 4 P. M.        |                 | 530'                        | E.                |         | Faint airs, calms, heavy<br>southerly sea.                                                                                                                                                                                      |
|                       | 8 P. M.        |                 | 590'                        | N. W.             |         | Cloudy with lightning.                                                                                                                                                                                                          |
|                       | Midnt.         |                 | 550'                        | N. W.             |         | Cloudy.                                                                                                                                                                                                                         |
| Prince Agna-<br>deo   | 4 A. M.        |                 |                             | N.                | Light.  | 4 A. M. Heavy cloudy<br>and unsettled looking<br>weather. Much light-<br>ning and southerly<br>swell. Noon, simi-<br>lar looking weather,<br>light variable airs;<br>unsettled looking all<br>round, high souther-<br>ly swell. |
|                       |                | N. E.           |                             |                   |         |                                                                                                                                                                                                                                 |
|                       | Noon           | 19° 52' 87° 9'  | 29° 600'                    | N. to NE.         | Light.  |                                                                                                                                                                                                                                 |
|                       |                |                 |                             |                   |         |                                                                                                                                                                                                                                 |
|                       | 8 P. M.        |                 |                             | W. to<br>W. N. W. | Gentle. | 8 P. M. same weather,<br>much lightning.                                                                                                                                                                                        |
|                       |                |                 |                             |                   |         |                                                                                                                                                                                                                                 |
| Scottish<br>Chieftain | 4 A. M.        |                 | 29° 610'                    | S. S. W.          |         | A strong current set-<br>ting about W. Winds<br>very unsteady in<br>force and direction.                                                                                                                                        |
|                       | 8 A. M.        | N. E.           |                             | S. E.             |         |                                                                                                                                                                                                                                 |
|                       | Noon           | 20° 04' 86° 58' | 600'                        | E.                |         |                                                                                                                                                                                                                                 |
|                       | 4 P. M.        |                 |                             | E. S. E.          |         |                                                                                                                                                                                                                                 |
|                       | 8 P. M.        |                 |                             | E. N. E.          |         |                                                                                                                                                                                                                                 |
|                       | Midnt.         |                 | 580'                        | S. E.             |         |                                                                                                                                                                                                                                 |

| Vessel.    | Hour.   | Latitude.  | Longitude. | Probable reduced barometer. | Wind.    |        | REMARKS.                                                                             |
|------------|---------|------------|------------|-----------------------------|----------|--------|--------------------------------------------------------------------------------------|
|            |         |            |            |                             | Dir.     | Force. |                                                                                      |
| Roma ...   | 4 A. M. |            |            |                             | W.       | .      | 4 A. M. swell from S. S. W. overcast sky and rain.                                   |
|            | 8 A. M. |            |            |                             | North    | 3      | 8 A. M. Gentle breeze, sky clearing at intervals.                                    |
|            | Noon    | N. 20° 19' | E. 86° 50' |                             | N.       | 3      | Noon, similar weather with southerly swell, light breeze, sky clearing at intervals. |
|            | 4 P. M. |            |            |                             | N. E.    | 1      |                                                                                      |
|            | midnt.  |            |            |                             | N. E.    | 1      | 10 P. M. light showers.                                                              |
| Commilla . | 4 A. M. |            |            | 29·635                      | E. N. E. | 3      | Light cloudy weather.                                                                |
|            | 8 A. M. |            |            | ·642                        | E. N. E. | 3      |                                                                                      |
|            | Noon    | N. 22° 21' | E. 91° 50' | ·607                        | E. N. E. | 4      |                                                                                      |
|            | 4 P. M. |            |            |                             | East     | 4      | Threatening appearance to S. E. Squally with very heavy rain.                        |
|            | 8 P. M. |            |            | ·543                        | S. S. E. | 4      | Continuous heavy rain.                                                               |

The Nancowry and Port Blair observations prove that strong steady south-westerly winds continued to blow in that part of the Bay. These winds were also extending to Diamond Island. The average wind velocity during the past 24 hours at that station was 10 miles, and for the previous day had been 8 miles per hour. The sea was also reported to be rising. Hence it is certain that the vigorous current indicated by the strong winds at Port Blair on the 25th was steadily advancing up the east of the Bay, and that its front was off the West Burmese coast on the morning of the 26th. The Pemba, which left Rangoon at 10 A. M., had south-westerly winds of force 5 with frequent rain squalls, as she advanced westwards in the Martaban Gulf to the south of the Burmese coast.

It is almost certain that this strong current was giving heavy rain over a portion of the north-east of the Bay in the neighbourhood of the Burmese and Arracan coasts. The direct evidence of this does not appear in the extracts from the logs of the vessels given above, but it will appear in those for the 27th. It is, however, indicated by the large rain-fall at Diamond Island and other stations in South Burmah and in Arracan.

For the present we shall accept it as almost certain that in the front

of this advancing strong moisture current, where the resistance to its advance was greatest, and where therefore ascensional motion was necessarily occurring to a large extent, rainfall of a more or less concentrated character was going on. The current was being deflected to the west by the coast and the Burmese and Arracan hills, and was moving more rapidly in its eastern than in its western portion. Hence probably also arose a strong tendency to an eddying motion in front and towards the west. The various actions going on were thus such as might set up vorticose motion. That such a result was taking place was indicated by the wind observations of all the vessels near the Head of the Bay. The Himalaya, in Lat.  $17^{\circ} 32' N.$  and Long.  $84^{\circ} 75' E.$ , had moderate westerly winds. The India, British Princess, Star of Albion, Scottish Chieftain, Saint Magnus, Roma, and Prince Amadeo, which were all between Lat.  $19^{\circ} 20' N.$  and  $20^{\circ} 19' N.$  and between Long.  $86^{\circ} 20' E.$  and  $87^{\circ} 18' E.$ , experienced light unsteady north-easterly winds. The weather was fine and sky clear during the greater part of the day, but became more clouded during the evening. There was a heavy swell from the south during the day. This was evidently due to the strong winds and high sea prevalent in the centre and south-east of the Bay. The only log which gives any indication of the subsequent weather is that of the Prince Amadeo, in which the Captain notes that, although light variable airs were blowing, the appearance of the sky was unsettled in all directions. Probably the light green sky to the east noted by the Captain of the British Princess was another sign of the large amount of moisture brought up by the southerly winds in the East of the Bay.

The various observations of the 26th hence indicate that cyclonic motion on a considerable scale commenced on the afternoon of the 25th over a portion of the Head of the Bay. The atmospheric whirl was fed and maintained by a very strong south-westerly air current moving northwards up the Bay near the Burmah and Arracan coast. It was apparently formed in the front of this air-current, and was causing winds to draw round over the north-west of the Bay. The indraught from that quarter was, however, feeble and unimportant, except as an indicator of bad weather to the south-east.

*27th June.*—The decrease of pressure which commenced on the 26th had now extended over the whole country. The change was still greatest in the north. On the northern frontier of the Punjab, in Eastern and Lower Bengal, and at Akyab the decrease exceeded one-tenth of an inch. It was smallest in parts of Bombay and Madras, where it only amounted to two or three-hundredths of an inch. A considerable depression lay over the Punjab. This, however, is a frequent feature of the hot weather months of June and July in that province. A smaller depression was, however,

forming at the Head of the Bay to the south of Saugor Island. Pressure ranged from 29·9 inches in Ceylon to 29·28 inches at Peshawar.

The wind was from directions between south-west and west over the Peninsula. In the neighbourhood of the two depressions, cyclonic circulations were established. Up the Gangetic valley the wind had a general easterly direction. The weather was cloudy and gloomy in all parts of the country except in the upper districts of the Punjab. Rain in small amounts had fallen during the preceding 24 hours, except in the Punjab, Sind, and West Madras. The rainfall was heavier on the Bombay coast than it had been hitherto, and strong monsoon winds were blowing there.

The following table gives the observations at the selected stations on and over the coast of the Bay on the 27th :—

| STATIONS.            | 10<br>Bar<br>red<br>sea lev | range<br>since<br>terday. | Wind.    |          | average<br>velocity | Wind<br>direction | 10 A. M.<br>Cloud. | Rainfall of<br>previous<br>24 hours. |
|----------------------|-----------------------------|---------------------------|----------|----------|---------------------|-------------------|--------------------|--------------------------------------|
|                      |                             |                           | 10 h.    | 16 h.    |                     |                   |                    |                                      |
| Nancowry . . . . .   | 29·912                      | —·003                     | S. W.    | S. S. W. |                     | 136               | 8                  |                                      |
| Port Blair . . . . . | 29·853                      | —·033                     | S. W.    | S. W.    |                     | 118               | 10                 |                                      |
| Diamond Island ..    | 29·763                      | —·038                     | S. S. W. | S. S. W. |                     | 175               | 8                  | 1·79                                 |
| Akyab .....          | 29·606                      | —·105                     | S. S. E. | S. S. E. |                     | 150               | 10                 | 0·57                                 |
| Chittagong .....     | 29·578                      | —·082                     | E. N. E. | S. E.    |                     | 43                | 4                  | 1·02                                 |
| Dacca .....          | 29·566                      | —·116                     | E.       | E.       |                     | 38                | 8                  | 1·16                                 |
| Jessore .....        | 29·604                      | —·069                     | E. N. E. | E.       |                     | 120               | 10                 | 0·04                                 |
| Calcutta (Alipore)   | 29·529                      | —·117                     | E. S. E. | E.       |                     | 83                | 9                  | 0·20                                 |
| Saugor Island ...    | 29·532                      | —·115                     | N. N. E. | N. E.    |                     | 250               | 7                  | 0·09                                 |
| Balasore .....       | 29·537                      | —·099                     | N.       | ?        |                     | ?                 | 8                  | 0·40                                 |
| Cuttack .....        | 29·565                      | —·061                     | N. W.    | N. N. W. |                     | 75                | 10                 | 1·01                                 |
| False Point .....    | 29·544                      | —·077                     | W.       | W. S. W. |                     | 70                | 10                 | 0·26                                 |
| Vizagapatam .....    | 29·634                      | —·034                     | W.       | W. S. W. |                     | 175               | 10                 | 1·70                                 |

The preceding observations show that pressure had decreased rapidly over the north of the Bay and the adjacent coasts during the preceding 24 hours. The fall was greatest in South-West Bengal and more especially at Saugor Island. The distribution of pressure, taken in connection with the wind directions at the Bengal and Orissa stations, in-

dicates that there was now a well-defined atmospheric whirl at the Head of the Bay, the centre of which was at a little distance to the S. S. E. of Saugor Island. Pressure was below the normal for the day over the province of Bengal by amounts varying from  $\cdot 1''$  at Chittagong to zero at Patna. Winds were very light over the whole province. Northerly winds had fully set in over South-West Bengal and Orissa, whilst winds more or less easterly prevailed over East and North Bengal, Behar, and Chutia Nagpore.

This weakness of the winds is shown by the following observations :—

|                  | Amount of<br>wind<br>during<br>24 hours<br>preceding<br>10 A. M. | Average<br>wind<br>amount.<br>June. | Percentage<br>of actual<br>to average. |
|------------------|------------------------------------------------------------------|-------------------------------------|----------------------------------------|
| Calcutta .....   | 139·0                                                            | 152·3                               | 91·3                                   |
| Berhampore ..... | 94·7                                                             | 132·3                               | 71·6                                   |
| Dacca .....      | 63·1                                                             | 183·7                               | 34·3                                   |
| Purneah .....    | 24·0                                                             | 94·4                                | 25·3                                   |
| Hazaribagh ..... | 130·5                                                            | 214·9                               | 60·9                                   |

The slight indraught to the cyclonic disturbance from the north and east had already diminished the humidity of the air and the amount of cloud in North Bengal and Behar. The sky was overcast in Orissa and South-West Bengal and the southern districts of East Bengal. The rainfall in the province was small in amount and localized in its distribution, except in Orissa and the southern districts of South-West Bengal, where moderate rain had already begun to fall in connection with the cyclonic disturbance.

The weather in Orissa at this time is described as unsettled. Winds were light and variable and gave occasional showers of rain.

The following table gives the average rainfall in each of the divisions of Bengal for the 24 hours preceding 6 P. M. :—

*Rainfall Table of the 27th June 1883.*

| Province.                                  | Number of<br>stations<br>in each<br>division. | Average<br>Rainfall of<br>preceding<br>24 hours. | Heaviest fall<br>reported in<br>24 hours. |
|--------------------------------------------|-----------------------------------------------|--------------------------------------------------|-------------------------------------------|
| Orissa .....                               | 16                                            | 0·17                                             | 2·25                                      |
| South-West Bengal .....                    | 46                                            | 0·28                                             | 2·20                                      |
| East Bengal .....                          | 26                                            | 0·49                                             | 2·50                                      |
| North Bengal .....                         | 27                                            | 0·09                                             | 0·57                                      |
| North Behar .....                          | 16                                            | 0·13                                             | 0·67                                      |
| South Behar .....                          | 17                                            | 0·16                                             | 0·69                                      |
| Sonthal Pergunnahs and<br>Chutia Nagpore } | 16                                            | 0·24                                             | 0·84                                      |

The meteorological extracts from logs of the vessels relating to the 27th of June are tabulated below for reference.

| Vessel.        | Hour.   | Latitude.  | Longitude.    | Probable reduced barometer. | Wind.     |        | REMARKS.                                                                                                 |
|----------------|---------|------------|---------------|-----------------------------|-----------|--------|----------------------------------------------------------------------------------------------------------|
|                |         |            |               |                             | Dir.      | Force. |                                                                                                          |
| Bancoora       | 4 A. M. |            |               | 29.751                      | S. W.     | 4      | Brisk breeze, fine.                                                                                      |
|                | 8 A. M. |            |               | .796                        | SW. by S. | 4      | Fresh following wind and fine.                                                                           |
|                | Noon    | N. 11° 42' | E. 84° 8' 30" | .796                        | S. W.     | 4      | Current S. 23 W. 17 miles.                                                                               |
|                | 4 P. M. |            |               | .706                        | S. W.     | 4      | Fresh following wind and fine.                                                                           |
|                | 8 P. M. |            |               | .816                        | S. W.     | 5      | Strong breeze and overcast.                                                                              |
|                | Midnt.  |            |               |                             | .         |        | Less wind with occasional rain.                                                                          |
| Pemba          | 4 A. M. |            |               | 29.690                      | S. W.     | 5      | A. M. Fresh breeze with moderate sea and occasional rain squalls.                                        |
|                | 8 A. M. |            |               | .720                        | S. S. W.  | 6      | 6-15 A. M. Passed Al-guada.                                                                              |
|                | Noon    | N. 16° 13' | E. 93° 30'    | .720                        | S. S. W.  | 7      | Noon. Strong breeze with rising sea.                                                                     |
|                | 4 P. M. | (by D.R)   | (by D.R)      | .690                        | S. S. W.  | 9      | Afternoon. Wind rapidly increased to a strong gale with furious squalls, blowing away sails and awnings. |
|                | 8 P. M. |            |               | .660                        | S. S. W.  | 9      |                                                                                                          |
|                | Midnt.  |            |               | .640                        | S. S. W.  | 9      |                                                                                                          |
| Himalaya       | 4 A. M. |            |               | 29.514                      | N. W.     |        |                                                                                                          |
|                | 8 A. M. |            |               | .549                        | N. N. W.  |        |                                                                                                          |
|                | Noon    | N. 19° 58' | E. 86° 32'    | .484                        | N. E.     |        | Moderate breeze and fine.                                                                                |
|                | 4 P. M. |            |               | .404                        | N.        |        |                                                                                                          |
|                | 8 P. M. |            |               | .447                        | N.        |        |                                                                                                          |
|                | Midnt.  |            |               | .359                        | N. N. W.  |        | Overcast with rain.                                                                                      |
| Star of Albion | 8 A. M. |            |               |                             |           |        |                                                                                                          |
|                | Noon    | N. 20° 10' | E. 87° 28'    | 29.500                      | W.        | 4      | Squally, with rain distant thunder to Northward and heavy looking clouds.                                |
|                | 4 P. M. |            |               |                             | N. W.     | 4      | Clearer to S. E.                                                                                         |

| Vessel.             | Hour.   | Latitude.  | Longitude. | Probable reduced barometer. | Wind.    |       | REMARKS.                                                                                    |
|---------------------|---------|------------|------------|-----------------------------|----------|-------|---------------------------------------------------------------------------------------------|
|                     |         |            |            |                             | Dir.     | Force |                                                                                             |
| British Princess    | 4 A. M. |            |            |                             | N. W.    | 5     | Cloudy sky, southerly swell.                                                                |
|                     | 8 A. M. |            |            |                             | N. W.    | 5     | Heavy squall with rain, overcast, passing showers.                                          |
|                     | Noon    | N. 20° 38' | E. 88° 2'  | 29.500                      | N. W.    | 5     | Heavy rain at intervals, sky overcast and weather finer.                                    |
|                     | 4 P. M. |            |            |                             | N. W.    | 5     | Sky looking very unsettled patches of green colour.                                         |
|                     | 8 P. M. |            |            |                             | N. W.    | 6     | 11 P. M. Heavy bank of clouds in the N. W. with vivid lightning, distant thunder, and rain. |
|                     | Midnt.  |            |            |                             | N. W.    | 7     |                                                                                             |
| Scottish Chieftain. | 4 A. M. |            |            |                             | W. S. W. | 1     | The whole of this day, the weather has been very unsteady. — Strong westerly current.       |
|                     | 8 A. M. |            |            | 29.520                      | S. W.    | 2     |                                                                                             |
|                     | Noon    | N. 20° 40' | E. 87° 50' | .480                        | S. W.    | 3     |                                                                                             |
|                     | 4 P. M. |            |            | .460                        | N. W.    | 4     |                                                                                             |
|                     | Midnt.  |            |            | .450                        | N. W.    | 5     |                                                                                             |
| Saint Magnus        | 4 A. M. |            |            | 29.500                      | W. N. W. |       | Cloudy, rainy, squally weather.                                                             |
|                     | 8 A. M. |            |            | .540                        | North    | 5     | Thick rainy weather.                                                                        |
|                     | Noon    | N. 20° 44' | E. 87° 54' | .450                        | N. W.    | 5     | Cloudy and passing showers.                                                                 |
|                     | 4 P. M. | (by D. R.) |            | .400                        | N. W.    | 2     | Squally, rainy weather.                                                                     |
|                     | 8 P. M. |            |            | .460                        | N. N. W. | 4     |                                                                                             |

| Vessel.        | Hour.   | Latitude.             | Longitude.            | Probable reduced barometer. | Wind.    |        | REMARKS.                                                                                                                                                   |
|----------------|---------|-----------------------|-----------------------|-----------------------------|----------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                |         |                       |                       |                             | Dir.     | Force. |                                                                                                                                                            |
| Prince Amadeo  | 4 A. M. |                       |                       |                             | N. W.    |        | Midnight—Moderate W. to W. N. W. winds unsettled looking weather.                                                                                          |
|                | Noon    | N. 20° 46' (by D. R.) | E. 87° 35' (by D. R.) | 29.500                      |          | Vble   | 4 A. M. Squally with heavy rain. Noon, squally winds from N. W. to N. E., much rain high S. to S. S. E. swell. 8 P. M. Moderate N. W. winds, weather same. |
| India .....    | 4 A. M. |                       |                       | 29.530                      | E.       | 3      | Moderate and overcast.                                                                                                                                     |
|                | 8 A. M. |                       |                       | 520                         | E.       | 2      |                                                                                                                                                            |
|                | Noon    | N. 20° 39'            | E. 88° 5'             | 520                         |          |        |                                                                                                                                                            |
| Roma .....     | 4 A. M. |                       |                       |                             | ..       | 3      | A. M. Light showers                                                                                                                                        |
|                | 8 A. M. |                       |                       |                             | ...      | 5      |                                                                                                                                                            |
|                | Noon    |                       |                       |                             | N. E.    | ...    | 3 A. M. Anchored at Saugor. 9 A. M. proceeded up the river, weather showery.                                                                               |
| Commilla ..... | 8 A. M. |                       |                       | 29.523                      | S. S. E. | 3      | Cloudy and threatening to S. E.                                                                                                                            |
|                | Noon    | N. 22° 21'            | E. 91° 50'            | 499                         | S. S. E. | 4      | Heavy unsettled appearance to S. E.                                                                                                                        |
|                | 4 P. M. |                       |                       | 396                         | South    | 4      | Squally unsettled appearance to S. E.                                                                                                                      |
|                | 8 P. M. |                       |                       | 411                         | S. S. E. | 4      | Hard squalls and threatening appearance with light rain at times. High sea getting up from S.                                                              |
|                | Midnt.  |                       |                       | 379                         | S. S. W. | 5      | Wild squally weather. High sea from S. S. W. Rain at times.                                                                                                |



The strong south-west monsoon winds which the meteorology of the 26th showed to be advancing northwards up the eastern part of the Bay, were on the morning of the 27th not far from the Head of the Bay and were certainly in the parallel of Akyab. The wind velocity was very considerable at Port Blair and Nancowry. Strong winds were also blowing at Diamond Island, where the sea was now rough. The wind velocity at Akyab had increased from a rate of 4 miles per hour to 6 miles per hour, the average force of the wind in June at that station being 4 miles. The remarks in the log of the *Pemba* are very valuable. She passed round Cape Negrais into the Bay to the west of Burma in the morning. The wind increased very rapidly to a strong gale and blew in furious squalls. The wind was steady at S. S. W. and of average force 9. On the other hand, the winds at the stations in South Bengal and Orissa, and also those observed at the Light Vessels and the vessels near the Head of the Bay, were very feeble. The only conclusion warranted by the evidence is that these strong winds on the Burmah and Arracan coast were feeders to an ascending current to the northward; and that the ascensional movement was hence near the Head of the Bay, and was partly maintained by the rainfall accompanying the ascensional motion, and by the various resistances to the motion of the strong current advancing northwards. The south-west winds, it has already been remarked, were much stronger than those from any other direction. It is, so far as can be judged, probable, if not certain, that the whirl was not at this time a fully developed cyclonic disturbance with a well-defined centre. The centre of the barometric depression at the Head of the Bay can only be roughly approximated from the observations. Its most probable position at noon was in Lat.  $20\frac{1}{2}^{\circ}$  N. and Long.  $89\frac{3}{4}^{\circ}$  E. and almost identical with its position at 10 A. M. Assuming this position of the centre of depression, the relative positions of the Light Vessels at 10 A. M. and of the ships at Noon are given in the following table :—

|                               | Time.    | Position.           |                    | Barometer. | Wind.      |           | Direction of Centre. | Distance from probable position of Centre. | Weather. |
|-------------------------------|----------|---------------------|--------------------|------------|------------|-----------|----------------------|--------------------------------------------|----------|
|                               |          | Latitude.           | Longitude.         |            | Direction. | Strength. |                      |                                            |          |
| Saugor Island Light House...  | 10 A. M. | N. $21^{\circ} 39'$ | E. $88^{\circ} 5'$ | 29.505     | N. N. E.   |           |                      | Miles. 120                                 | Cloudy.  |
| Upper Gasper Light Vessel ... |          | N. $21^{\circ} 31'$ | E. $88^{\circ} 3'$ | 29.484     | N. E.      | 4         | ESE                  | 120                                        | Squally. |

|                                 | Time. | Position.    |               | Barometer. | Wind.      |           | Direction of centre. | Distance from probable position of centre. | Weather, &c               |
|---------------------------------|-------|--------------|---------------|------------|------------|-----------|----------------------|--------------------------------------------|---------------------------|
|                                 |       | Latitude. N. | Longitude. E. |            | Direction. | Strength. |                      |                                            |                           |
| Intermediate Light Vessel...    | Noon. | 21° 15'      | 88° 11'       | 29.472     | E.N.E.     | 3         | ESE                  | miles 115                                  | Showery.                  |
| Eastern Channel Light Vessel... | ...   | 21° 1'       | 88° 12'       | 29.478     | N.N.E.     | 5         | ESE                  | 105                                        | High Sea.                 |
| Balasore .....                  | ...   | 21° 30'      | 86° 50'       | 29.479     | N.         |           | ESE                  | 205                                        | Gloomy.                   |
| False Point .....               | ...   | 20° 20'      | 86° 47'       | 29.522     | S. W.      |           | E.                   | 195                                        | Gloomy.                   |
| Saint Maguns.....               | ...   | 20° 44'      | 87° 54'       | 29.450     | N. W.      | 5         | E.                   | 120                                        | Squally.                  |
| Scottish Chieftain              | ..    | 20° 40'      | 87° 50'       | 29.480     | S. W.      | 3         | E.                   | 120                                        | Unsettled.                |
| Star of Albion ...              | ...   | 20° 10'      | 87° 28'       | 29.570     | W.to S. W. | 4         | ENE                  | 150                                        | Squally.                  |
| British Princess                | ...   | 20° 38'      | 88° 2'        | 29.500     | N. W.      | 5         | E.                   | 110                                        | Unsettled.                |
| Prince Amadeo ...               | ...   | 20° 46'      | 87° 35'       | 29.500     | W.to N. E. |           | E.                   | 145                                        | Squally.                  |
| Himalaya                        | ...   | 19° 58'      | 86° 32'       | 29.484     | N. E.      |           | ENE                  | 210                                        | Fine.                     |
| Pemba ....                      | ...   | 16° 13'      | 93° 30'       | 29.720     | S.S.W.     | 7         | N. W.                | 380                                        | Strong increasing breeze. |

The position of the centre at 4 P. M. was probably almost identical with its position at noon. The following observations taken at 4 P. M. indicate that it was at that hour in Lat. 20° 35' N. and Long. 89° 35' E.

|                                 | Position.    |               | Barometer. | Wind.      |           | Direction of centre. | Distance from probable position of centre. | Weather, &c. |
|---------------------------------|--------------|---------------|------------|------------|-----------|----------------------|--------------------------------------------|--------------|
|                                 | Latitude. N. | Longitude. E. |            | Direction. | Strength. |                      |                                            |              |
| Saugor Island Light House...    | 21° 39'      | 88° 5'        | 29.407     | N. E.      | Light.    | S. E.                | miles 125                                  | Cloudy.      |
| Upper Gasper Light Vessel...    | 21° 31'      | 88° 3'        | 29.375     | Calm.      | 0         | E. S. E.             | 120                                        |              |
| Intermediate Light Vessel...    | 21° 15'      | 88° 11'       | 29.355     | N. N. E.   | 1         | E. S. E.             | 102                                        | Sea rough.   |
| Eastern Channel Light Vessel... | 21° 1'       | 88° 12'       | 29.377     | N. E.      | 2½        | S. E.                | 95                                         | Stormy.      |
| False Point .....               | 20° 20'      | 86° 47'       | 29.406     | W. S. W.   | moderate  | E.                   | 175                                        | Gloomy.      |

The *Bancoora* was in Lat.  $11^{\circ} 42'$  N. and Long.  $84^{\circ} 8'$  E. at noon. She had strong steady south-west winds of force 4 during the day, with overcast skies and occasional rain.

The *Pemba* was in the north of the Gulf of Martaban early in the morning, when she experienced fresh breezes with moderate sea and occasional rain-squalls. She doubled Cape Negrais and passed into the Bay of Bengal about midday. The wind began to increase rapidly, and during the afternoon and evening it blew a gale with furious squalls, which carried away her sails and awnings. The wind blew steadily from the S. S. W. during the afternoon with average force 9.

The remaining vessels were all in the north-west angle of the Bay. They were the *India*, *Himalaya*, *Star of Albion*, *Scottish Chieftain*, *Saint Magnus*, *British Princess*, and *Prince Amadeo*, and were at noon between Lat.  $19^{\circ} 58'$  and Lat.  $20^{\circ} 46'$  N. and between Long.  $86^{\circ} 32'$  and  $88^{\circ} 5'$  E. Their observations enable the storm-centre to be approximately identified, as in the majority of these vessels the usual midday observations were taken; so that the positions of the vessels are known in nearly all cases with approximate exactness at noon of this day.

The *Saint Magnus* and *British Princess* were very near each other. The former was in Lat.  $20^{\circ} 40'$  N. and Long.  $87^{\circ} 50'$  E. and the latter in Lat.  $20^{\circ} 38'$  N. and Long.  $88^{\circ}$  E. Both experienced strong currents during the day. These two vessels were probably nearest the centre, but in the westerly quadrant. They had squally weather with thick rain and north-westerly winds of average force 5.

The *Scottish Chieftain*, which was about 10 miles to the west of the previous vessels, had very variable winds during the day, which increased in force from 1 to 5. They shifted from W. S. W. to S. W., and then hauled to N. W. She experienced a strong westerly current.

The *Prince Amadeo*, about 15 miles further to the west, in Lat.  $20^{\circ} 46'$  N. and Long.  $87^{\circ} 35'$  E., had unsettled weather with light variable winds and heavy rain. She experienced a strong southerly current.

The *Himalaya*, which was considerably further to the west and near the Orissa coast, had moderate north-easterly breezes and fine weather.

*28th June.*—The barometer rose quickly in the Punjab, during the previous 24 hours, and was standing at its normal height at 10 A. M. Pressure continued to give way over the rest of India. The fall was not large in amount, except in and near the depression at the Head of the Bay. The barometer had fallen at Saugor Island from  $29.53''$  at 10 A. M. on the 27th to  $29.37''$  at the same hour of the 28th.

The wind had backed to south-west and south over the Central Provinces, Central India, and Rajputana. This was evidently due to the continuance of strong westerly winds on the Bombay coast and their

extension eastwards over the centre and north of the Peninsula. Light easterly winds were blowing, as on the 27th, up the Gangetic plain, indicating that the circulation was as yet unaffected in direction by the atmospheric whirl in the north of the Bay. To the north of the centre of depression, or in South Bengal, the circulation was increasing, but was still very weak. The weather was generally cloudy, and rain had fallen in moderate amounts over the same areas as on the 27th.

The observations at the selected stations in Bengal are given below :

| Stations.          | Barometer at<br>10 A. M. reduced<br>to sea level. | Change since<br>yes day. | Wind.    |          | W<br>ve-<br>vic | of pre-<br>sures.<br>percentage<br>wind. | 10 A. M.<br>Cloud. | Rainfall<br>of pre-<br>vious<br>24 hours. |
|--------------------|---------------------------------------------------|--------------------------|----------|----------|-----------------|------------------------------------------|--------------------|-------------------------------------------|
|                    |                                                   |                          | 0 h      | 6 h      |                 |                                          |                    |                                           |
| Nancowry .....     | 29·913                                            | +·001                    | S. W.    | S. W.    | 13              | 118                                      | 6                  | nil.                                      |
| Port Blair .....   | 29·856                                            | +·003                    | S. W.    | S. W.    | 12              | 109                                      | 6                  | 0·13                                      |
| Diamond Island     | 29·807                                            | +·044                    | S.       | S. S. W. | 29              | 363                                      | 9                  | 0·25                                      |
| Akyab .....        | 29·639                                            | +·033                    | S.       | S. S. W. | 12              | 300                                      | 10                 | 6·84                                      |
| Chittagong .....   | 29·571                                            | —·007                    | S. E.    | E. S. E. | 9               | 120                                      | 9                  | 3·81                                      |
| Dacca .....        | 29·526                                            | —·040                    | E.       | E.       | 6               | 75                                       | 10                 | 0·85                                      |
| Jessore .....      | 29·445                                            | —·159                    | E.       | E. S. E. | 6               | 120                                      | 10                 | 0·10                                      |
| Calcutta (Alipore) | 29·392                                            | —·137                    | E.       | E. by N. | 9               | 150                                      | 10                 | 0·22                                      |
| Saugor Island ...  | 29·374                                            | —·158                    | N. N. E. | N. N. E. | 8               | 57                                       | 10                 | 0·91                                      |
| Balasore .....     | 29·423                                            | ·114                     | N.       | ?        | 2               | ?                                        | 10                 | 0·32                                      |
| Cuttack .....      | 29·507                                            | —·058                    | calm.    | N. W.    | 4               | 100                                      | 10                 | 0·62                                      |
| False Point .....  | 29·452                                            | —·092                    | W. S. W. | W. S. W. | 10              | 100                                      | 10                 | 4·84                                      |
| Vizagapatam ...    | 29·614                                            | —·020                    | W.       | W.       | 7               | 175                                      | 10                 | 0·20                                      |

Pressure had given way over the whole of the Province of Bengal, and was below the normal of the day by amounts varying between ·05" at Patna and ·25" at Saugor Island. The air-motion over the whole of Bengal was now largely dependent on the cyclonic vortex. In East and South-West Bengal winds ranged between east and north-east. Northerly winds prevailed at Balasore, and south-west winds at Gopalpore and False Point. The air was calm at 10 A. M. at Cuttack. Over North Bengal,

Behar, and Chutia Nagpore light easterly winds were blowing. The indraught to the vortex had diminished the humidity and cloud-amount considerably in North Bengal and Behar during the previous 24 hours, as shown by the following results :—

|                    | 10 A. M.<br>Average Humidity. |       | Average<br>Cloud Amount. |       |
|--------------------|-------------------------------|-------|--------------------------|-------|
|                    | 27th.                         | 28th. | 27th.                    | 28th. |
| North Bengal ..... | 81                            | 73    | 6·0                      | 4·0   |
| North Behar .....  | 79                            | 72    | 4·8                      | 3·2   |
| South Behar .....  | 80·5                          | 70·4  | 6·8                      | 4·4   |

The rainfall returns for the 24 hours previous to 6 P. M. indicate that moderate general rain had fallen over the whole of East and South-West Bengal, and that very heavy rain had been received in Orissa.

The following table gives the whole of the Orissa rainfall returns for the day :—

| District.  | Station.        | Rainfall. |
|------------|-----------------|-----------|
| Pooree ... | Pooree .....    | 0·59      |
|            | Khurdah .....   | 0·60      |
|            | Banpur .....    | nil.      |
|            | False Point ..  | 8·04      |
|            | Hookitola ..... | 3·68      |
| Cuttack .  | Jagatsingporo   | 7·50      |
|            | Banki .....     | 0·35      |
|            | Cuttack .....   | 1·79      |
|            | Kendrapara ..   | 2·70      |
|            | Jaipur .....    | 2·80      |
| Balasore . | Chandbali ..... | 3·25      |
|            | Bhuddruck ..    | 1·78      |
|            | Sora .....      | 1·50      |
|            | Balasore .....  | 0·94      |
|            | Jellasore ..... | 3·40      |
|            | Baripoda .....  | 1·12      |

The weather on the Orissa coast is thus described by an observer :  
 “Thick heavy weather with heavy rain and overcast skies prevailed”

during the day. At 4 P. M. it was blowing hard. Heavy rain fell all night with variable winds."

A few light showers fell in North Bengal and Chûtia Nagpore, but rain had almost entirely ceased in Behar.

The following table gives the average rainfall throughout the Province of Bengal, and indicates clearly its distribution :—

| District.                                   | Average<br>rainfall of<br>previous<br>24 hours. | Heaviest<br>rainfall<br>in 24 hours. |
|---------------------------------------------|-------------------------------------------------|--------------------------------------|
| Orissa.....                                 | 2.50                                            | 8.04                                 |
| South West Bengal ...                       | 0.15                                            | 0.76                                 |
| East Bengal .....                           | 0.65                                            | 6.46                                 |
| North Bengal .....                          | 0.17                                            | 1.25                                 |
| North Behar .....                           | 0.03                                            | 0.30                                 |
| South Behar .....                           | 0.01                                            | 0.10                                 |
| Chutia Nagpur and }<br>Sonthal Pergunnahs } | 0.13                                            | 0.70                                 |

The information respecting the weather in the Bay on the 28th June, extracted from the logs of the vessels, is given in the following statement :—

| Vessel.   | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable reduced<br>barometer. | Wind.    |        | REMARKS.                                 |
|-----------|---------|-----------------|------------------|--------------------------------|----------|--------|------------------------------------------|
|           |         |                 |                  |                                | Dir.     | Force. |                                          |
| Bancoora  | 4 A. M. |                 |                  | 29.653                         | S. W.    | 3      | Moderate breeze and puffy.               |
|           | 8 A. M. |                 |                  | .716                           | S. W.    | 3      | Overcast at times.                       |
|           | Noon    | 15° 08'         | 85° 33'          | .683                           | S. W.    | 3      | Moderate following wind and overcast.    |
|           | 4 P. M. |                 |                  | .801                           | S. W.    | 3      | Moderate breeze and overcast.            |
|           | 8 P. M. |                 |                  | .716                           | S. W.    | 3      | Moderate following wind and fair.        |
|           | Midnt.  |                 |                  | .671                           | S. W.    | 4      | Fresh breeze and cloudy.                 |
| Pemba ... | 4 A. M. |                 |                  |                                | S. S. W. | 9      | A. M. Strong gale with                   |
|           | 8 A. M. |                 |                  | 29.540                         | ...      | 9      | high sea and heavy                       |
|           | Noon    | 18° 34'         | 90° 59'          | .540                           | ...      | 9      | squalls. Noon. A heavy                   |
|           | 4 P. M. | Rangoon to-     |                  | .460                           | ...      | 9      | sea smashed in the port                  |
|           | 8 P. M. | wards Sand      |                  | .500                           | ...      | 9      | bulwark rail forward of                  |
|           | Midnt.  | Heads.          |                  | .520                           | ...      | 9      | bridge. Midnight. Very high sea running. |

| Vessel.            | Hour.   | Latitude.<br>N.     | Longitude.<br>E.   | Probable reduced<br>barometer. | Wind.                                       |        | REMARKS.                                                                                                                                                                                                            |
|--------------------|---------|---------------------|--------------------|--------------------------------|---------------------------------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |         |                     |                    |                                | Dir.                                        | Force. |                                                                                                                                                                                                                     |
| Star of Albion ... | 8 A. M. |                     |                    | 29.500                         |                                             |        | Wind freshening, weather cloudy and threatening.                                                                                                                                                                    |
|                    | Noon    | 20° 14'             | 88° 23'            | .450                           | N. by W.                                    | 5 to 8 | Continued lightning. Slight sea.                                                                                                                                                                                    |
|                    | 4 P. M. |                     |                    | .440                           | W. N. W.                                    |        | Latter part, strong gale with thick driving rain, and westerly sea.                                                                                                                                                 |
|                    | 8 P. M. |                     |                    | .490                           |                                             |        |                                                                                                                                                                                                                     |
|                    | Midnt.  |                     |                    | .470                           | West.                                       |        |                                                                                                                                                                                                                     |
| British Princess   | 4 A. M. |                     |                    |                                | N. W.                                       | 7      | 4 A. M. Heavy rain, vivid lightning with thunder.                                                                                                                                                                   |
|                    | 8 A. M. |                     |                    |                                | ...                                         | 7      | High confused sea. 8 A. M.                                                                                                                                                                                          |
|                    | Noon    | 20° 46'             | 88° 7'             | 29.420                         | W. N. W.                                    | 8      | Heavy squall with torrents of rain. Moderate gale, high confused sea.                                                                                                                                               |
|                    | 4 P. M. |                     |                    |                                | West                                        | 9      | Noon. Fresh gale, high confused sea. 4 P. M. Fresh gale, high sea, and heavy rain. 8 P. M. Heavy squalls, torrents of rain, high sea.                                                                               |
|                    | 8 P. M. |                     |                    |                                | S. W.                                       | 10     | Midnight. Furious squalls, torrents of rain, and high sea.                                                                                                                                                          |
|                    | Midnt.  |                     |                    |                                | ...                                         | 11     |                                                                                                                                                                                                                     |
|                    |         |                     |                    |                                | ...                                         | 11     |                                                                                                                                                                                                                     |
| Scottish Chieftain | 4 A. M. |                     |                    | 29.400                         |                                             | 1      | Noon. Weather very unsteady, much rain, thunder and lightning. Very strong westerly current.                                                                                                                        |
|                    | 8 A. M. |                     |                    | .300                           | N. N. W.                                    | 2      | Sky presenting a very wild appearance.                                                                                                                                                                              |
|                    | Noon    | 20° 50'             | 88° 10'            | .250                           | ...                                         | 3      |                                                                                                                                                                                                                     |
|                    | 4 P. M. |                     |                    | .220                           | N. W.                                       | 4      |                                                                                                                                                                                                                     |
|                    | Midnt.  |                     |                    | .200                           | W.                                          | 8      |                                                                                                                                                                                                                     |
| Saint Magnus ..... | 4 A. M. |                     |                    | 29.330                         | N. W.                                       | 6      | Heavy gusts and heavy continued rain.                                                                                                                                                                               |
|                    | 8 A. M. |                     |                    | .330                           |                                             |        | Strong winds and high sea.                                                                                                                                                                                          |
|                    | Noon    | 20° 52'             | 88° 3'             | .290                           | N. W.                                       | 4      | Winds and sea more moderate.                                                                                                                                                                                        |
|                    | 4 P. M. |                     |                    | .260                           | W. S. W.                                    | 6      | Terrific squalls. Tremendous sea at times.                                                                                                                                                                          |
|                    | 8 P. M. |                     |                    | .320                           | W. S. W.                                    | 2      | Heavy sea, dense darkness.                                                                                                                                                                                          |
| Prince Amadeo      | Midnt.  |                     |                    | .300                           | S. W.                                       | 10     | Furious gale, high squalls, heavy sea.                                                                                                                                                                              |
|                    | 4 A. M. |                     |                    |                                | N. W.                                       | Strong | Midnight. Boisterous squally weather with much heavy rain. 4 A. M.                                                                                                                                                  |
|                    | Noon    | Pilot bearing about | Brig N. E. 5 miles | 29.330                         | N. W. and W. N. W. Variable between W. & S. |        | Squally weather, high southerly sea. Noon. Squally unsettled weather. 4 P. M. Weather more moderate. 6 P. M. Weather having a wild unsettled appearance. 8 P. M. Heavy squalls from W. S. W. to S. S. W. much rain. |
|                    | 6 P. M. |                     |                    |                                |                                             |        |                                                                                                                                                                                                                     |
|                    |         |                     |                    |                                |                                             |        |                                                                                                                                                                                                                     |

| Vessel.  | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable reduced<br>barometer. | Wind.    |         | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------|---------|-----------------|------------------|--------------------------------|----------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |         |                 |                  |                                | Dir.     | Force.  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Commilla | 4 A. M. |                 |                  | 29.379                         | South    | 7       | 4 A. M. Very high sea from South and S. W. Breeze very variable in force with very hard squalls from S. S. W. and rain. 8 A. M. A very high sea running from S. S. W. Noon. Hard squalls from S. S. W. and very high sea from S. W. 4 P. M. Hard squalls from S. S. W. and very high sea from S. S. W. 6 P. M. Breeze very unsettled and hauling to N. W. at times. 6-30 P. M. Very heavy rain, tremendous sea from S. S. W. and S. W. 7 P. M. Eased down and stood S. by E. 7-30 P. M. Terrific sea carried away star-board cutter. 8 P. M. Terrific squalls from S. W. and very high sea. New jib and stay sail split. |
|          | 8 A. M. |                 |                  | .317                           | S. S. W. | 7 to 4  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | Noon    | 21° 04'         | 88° 31'          | .277                           | S. S. W. | 6       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | 4 P. M. |                 |                  | .121                           | S. W.    | 8       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | 6 P. M. |                 |                  |                                | Var.     | 6       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | 8 P. M. |                 |                  | .159                           | S. W.    | 9 to 10 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | Midnt.  |                 |                  | .182                           | S. W.    | 11      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Himalaya | 4 A. M. |                 |                  | 29.354                         | Variable |         | Fresh breeze and clondy, with frequent rain squalls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|          | 8 A. M. |                 |                  |                                | N.       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | Noon    | 22° 32'         | 88° 20'          | .264                           | N.       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | 4 P. M. |                 |                  | .354                           | N.       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | 8 P. M. |                 |                  | .449                           | N.       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|          | Midnt.  |                 |                  | .427                           | N.       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

The position of the centre of the barometric depression can be determined with approximate accuracy on the 28th. The observations at the Light Vessels show that it was in the immediate neighbourhood of the Sandheads at 10 A. M. It was hence very approximately in Lat. 21° 0' N. and in Long. 88° 45' E. The following table gives the barometric and wind observations taken at the Light Vessels and nearest



land stations, as well as the distance and direction of the centre (assuming this to be in the position assigned to it above) from each :—

|                   | Position.                     |                     | Wind 10 A. M. |          |        | Distance from probable position of centre. | Weather, &c.           |
|-------------------|-------------------------------|---------------------|---------------|----------|--------|--------------------------------------------|------------------------|
|                   | Latitud.<br>N.<br>right<br>E. | Baromet<br>10 A. M. | Direct        | right    | Force  |                                            |                        |
| Saugor Island     |                               |                     |               |          |        | miles                                      |                        |
| Light House...    | 21° 39' 88° 5'                | 29.340              | N.N.E         | Strong.  | S. E.  | 63                                         | Gloomy.                |
| Upper Gasper      |                               |                     |               |          |        |                                            |                        |
| Light Vessel...   | 21° 31' 88° 3'                | 29.32               | N. E.         |          | S. E.  | 57                                         | Threatening heavy sea. |
| Intermediate      |                               |                     |               |          |        |                                            |                        |
| Light Vessel...   | 21° 14' 88° 11'               | 29.241              | N.N.E.        |          | E.S.E. | 40                                         | Threatening.           |
| Eastern Channel   |                               |                     |               |          |        |                                            |                        |
| Light Vessel ...  | 21° 0' 88° 12'                | 29.209              | N.N.E.        |          | E.     | 35                                         | High sea.              |
| Balasore          | 21 30 86° 58'                 | 29.364              | N.            | Light.   | E.S.E. | 130                                        | Threatening.           |
| False Point ..... | 20° 20' 86° 47'               | 29.431              | W.S.W         | Moderate | E.N.E. | 135                                        | Gloomy.                |

The centre at this time was only at a distance of about 35 miles from two of the Light Vessels; yet these were experiencing comparatively feeble winds, as compared with the strong gales blowing, as the log of the Pemba proves, at distances of 200 and 300 miles from the centre in the south-easterly quadrant.

The ships' logs do not give 10 A. M. observations. Their positions are given for noon, together with barometric readings and wind directions and force. When these are charted, they indicate the existence of a centre of depression in about Lat. 21° 3' N. and Long. 88° 40' E. The following table gives the positions of the ships at noon, and the distance and direction of the centre (assuming the position of this to be in Lat. 21° 3' N. and Long. 88° 40' E.) in each case.

|                           | Position at noon. |           | Barometer at Noon. | Wind (Noon). |                | Direction of centre. | Distance from probable position of centre at Noon. | Weather.                         |
|---------------------------|-------------------|-----------|--------------------|--------------|----------------|----------------------|----------------------------------------------------|----------------------------------|
|                           | Lat. N.           | Long. E.  |                    | Direction.   | Strength.      |                      |                                                    |                                  |
| Sangor Island Light House | 21° 39'           | 88° 5'    | 29.311             | N. N. E.     | Light.         | S. E.                | 56                                                 | Overcast.                        |
| Commillah ...             | 21° 04'           | 89° 31'   | 29.277             | S. S. W.     | 6              | W.                   | 54                                                 | Hard squalls. Very high sea.     |
| Scottish Chieftain        | 20° 50'           | 88° 10'   | 29.250             | N. N. W.     | 3              | E. N. E.             | 35                                                 | Unsettled.                       |
| Saint Magnus              | 20° 52'           | 88° 3'    | 29.290             | N. W.        | 4              | E. N. E.             | 42                                                 | Strong wind. High sea.           |
| Prince Amadeo             | 20° 52'           | 88° 5' ?  | 29.330             | N. W.        | ...            | E. N. E.             | 40                                                 | Squally. High sea.               |
| British Princess          | 20° 46'           | 88° 7' ?  | 29.420             | N. W.        | 8              | E. N. E.             | 43                                                 | Heavy squalls. High sea.         |
| Star of Albion            | 20° 14' ?         | 88° 23' ? | 29.450             | N. by W.     | 5              | N. N. E.             | ?                                                  | Threatening weather. Slight sea. |
| Pemba ,.....              | 18° 34'           | 90° 59'   | ..                 | S. S. W.     | 9              | N. W.                | 225                                                | Strong gale. Heavy sea.          |
| False Point ...           | 20° 20'           | 86° 47'   | 29.309             | W. S. W.     | Mod-<br>erate. | E. N. E.             | 125                                                | Overcast.                        |

In examining the above, it should be remembered that the positions assigned to the Commillah, Scottish Chieftain, Saint Magnus, and Star of Albion were determined by observation at noon, and hence are assumed to be approximately correct. The position of the Prince Amadeo is stated to have been a few miles to the S. W. of the Pilot Brig. The position given has been determined from that statement on the assumption that the station for the Pilot Vessels during the S. W. monsoon, is at a distance of from 7 to 10 miles to the south or south-west of the Eastern Channel Light Vessel (*vide* Elson's Sandheads Sailing Directory, page 156); and is probably correct within five or six miles. The position of the British Princess at noon was ascertained by dead reckoning, and is certainly not correct, as all the vessels had drifted considerably with the currents now set up at the Head of the Bay. The noon observations of the barometer and wind direction indicate that she was probably in about Lat. 20° 55' and Long. 87° 45'.

The preceding table confirms much of the information given by the Light Vessels. The winds in the western quadrant, at distances of 30 to 50 miles from the centre, were very light and unsteady in force, as compared with those in the eastern quadrant. The barometric observations,

when charted, shew that the depression, as defined by the isobar of 29·3", was an elliptical shaped area at the centre of which the pressure probably did not exceed 29·2". The larger axis of this stretched E. N. E. and W. S. W., and was probably at least twice as long as the axis at right angles to it.

The observations taken on board the Light Vessels at 4 p. m. also enable the centre to be approximately determined at that hour. When charted, they indicate that the centre was in about Lat. 21° 10' N. and Long. 88° 30' E.

The following table shows that this gives consistent results for the direction and distance of the centre from each position :—

|                                            | Position.  |             | Baro-<br>meter. | Wind.      |                | Direction<br>of<br>centre. | Distance from<br>probable position<br>of centre. | Weather,<br>&c.              |
|--------------------------------------------|------------|-------------|-----------------|------------|----------------|----------------------------|--------------------------------------------------|------------------------------|
|                                            | Lat.<br>N. | Long.<br>E. |                 | Direction. | Strength.      |                            |                                                  |                              |
| Saugor Island<br>Light House               | 21° 30'    | 88° 5'      | 29·270          | N. N. E.   | Mode-<br>rate. | S. E.                      | 43                                               | Overcast.                    |
| Upper Gasper<br>Light Vessel               | 21° 31'    | 88° 3'      | 29·215          | N. E.      | 5              | S. E.                      | 38                                               | Heavy<br>sea.                |
| Intermediate<br>Light Vessel               | 21° 15'    | 88° 11'     | 29·155          | N.         | 4              | E. S. E.                   | 21                                               | Threa-<br>tening<br>weather. |
| Eastern Chan-<br>nel Light<br>Vessel ..... | 21° 1'     | 88° 12'     | 29·142          | N. W.      | 5 to 8         | E. N. E.                   | 23                                               | High sea<br>from<br>S. W.    |
| False Point<br>Light House                 | 20° 20'    | 86° 47'     | 29·301          | W. S. W.   | strong.        | E. N. E.                   | 125                                              | Overcast.                    |

These observations also show the weakness of the winds in the western quadrant. The Intermediate Light Vessel, although only 21 miles distant from the centre, experienced winds of force 4 at this time, whilst the Pemba, about 200 miles to the south-east, had winds of force 9 to 10.

Hence, the path of the centre during the day is determined by the positions given in the following table :—

| Hour.    | Latitude.  | Longitude. |
|----------|------------|------------|
| 10 A. M. | 21° 0' N.  | 88° 45' E. |
| Noon ... | 21° 3' N.  | 88° 40' E. |
| 4 P. M.  | 21° 10' N. | 88° 30' E. |

The character of the weather is fully shown by the reports given in the logs. Two vessels, the *Commilla* and *Pemba*, were in the east and south-east quadrants, in which alone the winds were violent. The *Pemba* was in Lat.  $18^{\circ} 14' N.$  and Long.  $90^{\circ} 59' E.$  by account at noon. She experienced strong S. S. W. gales during the whole day, with a high sea, and heavy rain squalls. A heavy sea smashed in her port bulwark rails early in the morning, after which the Captain eased the engines, and laid to, with the ship's head to S. S. E., during the greater part of the afternoon. The *Commilla*, which was proceeding from Chittagong to Calcutta, did not feel the full weight of the south-westerly winds until the afternoon, when she was between the Mutlah station and the Sandheads. She experienced, early in the morning, winds varying very considerably in force, with occasional hard squalls from S. S. W., and much rain. During the whole of the afternoon, she had very hard squalls with heavy rain, and a tremendous sea. At 7-20 P. M. a terrific sea carried away the starboard cutter. This was followed by very violent squalls of force 11 from the south-west.

The position of the *British Princess* was not ascertained by observation during the day, and it is almost certain that she must have drifted considerably with the strong currents set up at this time in the Head of the Bay. She was in the south-western quadrant in the morning, and had heavy rain with a high confused sea. The rainfall increased early in the morning, and during the greater part of the day she had "torrents of rain." The squalls also became heavier as the day advanced, and at midnight furious squalls (force 11) from the south-west passed over the vessel.

The *Saint Magnus* was in the western quadrant in the morning, when she had north-westerly winds of force 4 to 6. Heavy gusts of wind passed over the vessel, and continuous rain fell during the whole morning. In the evening, she was in the southerly quadrant, where she began to experience terrific squalls with a tremendous sea. At midnight, it was blowing a furious gale (force 10) from the south-west.

Hence, over a large area to the east and south-east of the central depression, violent south-westerly winds of force 9 to 11 were blowing at this time, producing a very high and dangerous sea near the Head of the Bay.

Further south, as shewn by the log of the *Bancoora*, the winds in the centre of the Bay (Lat.  $15^{\circ} N.$ , Long.  $83^{\circ} E.$ ) were of moderate force and gave very faint indications of the action and disturbance to the northward.

The *Star of Albion*, *Roma*, *Prince Amadeo*, and *Scottish Chieftain* were to the west of the centre of the whirl during the greater part of the day. The *Scottish Chieftain* was probably nearest to it at noon.

The position of the *Star of Albion* is doubtful. The weather was threatening in the morning, and the winds shifted from north through north-west to west in the evening, increasing in force during the day. In the afternoon and evening, as the wind backed to west, a strong gale set in with thick driving rain.

The Scottish Chieftain was in Lat.  $20^{\circ} 50' N.$  and Long.  $88^{\circ} 10' E.$  at noon. The winds were light during the morning; much rain fell, but it was not until midnight, when the wind hauled to west, that she began to have strong winds and rain squalls.

The Prince Amadeo was near the Pilot Station and to the west of the centre. Boisterous squalls with heavy rain and a high sea were experienced during the morning. In the evening, the weather had a very wild appearance. The wind shifted round to the south-west, and heavy squalls passed over the vessel, bringing up much rain.

The Light Vessels were all in the western quadrant during the day.

The Captain of the *Meteor* (Intermediate station) states that the winds were changeable between north and west, and that frequent heavy showers occurred during the day.

The Captain of the *Comet* (Upper Gasper Station) notes that the weather appeared very wild. Squalls with rain passed over the vessel, and a very heavy sea came up from the south-east.

*29th June.*—The changes of the barometer over India during the preceding 24 hours were partly due to the further development of the depression and cyclonic disturbance off the coast of the Sunderbunds, and partly to the appearance of a depression off the west coast.

The barometer at Saugor Island had fallen two tenths of an inch since 10 A. M. of the 28th, and by considerable amounts at all the Lower Bengal stations. It had risen in the surrounding districts, so that the differences of pressure had become considerably greater and the depression very marked. The disturbance was now giving strong easterly winds, with overcast skies and moderate rain, to East and South Bengal, and strong northerly and westerly winds and incessant rain to Orissa.

The barometer had also fallen considerably at Kurrachee, where very strong N. E. winds were blowing. The wind had backed from west to south-west along the Bombay coast, thus almost certainly indicating the appearance or formation of a depression off the west coast.

Over the Gangetic plain and the western Himalayas, variable winds obtained, with cloudy weather and light rain.

The following table gives the observations at the selected stations in the neighbourhood of the Bengal depression :—

| STATIONS.                     | Barometer at<br>10 A. M. reduced<br>to sea level | Change<br>yesterday | Wind.    |          | Average wind<br>velocity of previ-<br>ous 24 hours. | Pe  | 0 A. | Rainfall<br>of<br>previous<br>24 hours. |
|-------------------------------|--------------------------------------------------|---------------------|----------|----------|-----------------------------------------------------|-----|------|-----------------------------------------|
|                               |                                                  |                     | 10 h.    | 16 h.    |                                                     |     |      |                                         |
| Nancowry .....                | 29·914                                           | +·001               | S. W.    | S. W.    |                                                     | 73  | 7    | 2·21                                    |
| Port Blair.....               | 29·875                                           | +·019               | S. W.    | S. W.    | 13                                                  | 118 | 5    | 0·20                                    |
| Diamond Island\| | 29·835                                           | +·028               | S. S. W. | S. S. W. | 13                                                  | 163 | 8    | 0·40                                    |
| Akyab .....                   | 29·695                                           | +·056               | S. S. E. | S. S. E. | 11                                                  | 275 | 7    | 1·43                                    |
| Chittagong ...                | 29·608                                           | +·037               | S. E.    | E.       | 11                                                  | 157 | 10   | 2·31                                    |
| Dacca.....                    | 29·530                                           | +·004               | E.       | E.       | 13                                                  | 163 | 10   | 0·26                                    |
| Jessore .....                 | 29·445                                           | 0                   | E.       | E.       | 18                                                  | 360 | 10   | 0·78                                    |
| Calcutta (Ali-<br>pore) ..... | 29·322                                           | —·070               | E.       | E.       | 19                                                  | 317 | 10   | 0·64                                    |
| Saugor Island                 | 29·173                                           | —·201               | E.       | S. W.    | 26                                                  | 186 | 10   | ...                                     |
| Balasore .....                | 29·355                                           | —·068               | N. N. W. | ?        | 8                                                   | ?   | 10   | 1·22                                    |
| Cuttack .....                 | 29·463                                           | —·044               | N. W.    | W. N. W. | 6                                                   | 150 | 10   | 3·83                                    |
| False Point ...               | 29·440                                           | —·012               | W. S. W. | W. S. W. | 23                                                  | 230 | 10   | 8·22                                    |
| Vizagapatam...                | 29·613                                           | —·001               | S. W.    | W. by N. | 6                                                   | 150 | 10   |                                         |

The meteorological returns of the Bengal stations show that a large fall of the barometer had occurred in South-West Bengal and Orissa, whilst, over the remainder of the province, a considerable recovery of pressure was taking place. The depression off Saugor Island was now unusually large in amount, and such as is rarely observed in the rainy season. Pressure was below the normal of the day at all stations, by amounts varying between '01" at Durbhunga and '45" at Saugor Island. The atmospheric circulation in Bengal was now directly dependent on the cyclonic vortex off the coast of the Sunderbunds, and winds were very strong in the neighbourhood of the vortex in South-West Bengal, Orissa, and Chutia Nagpore. The winds in Chutia Nagpore and South Behar at 10 A. M. were from directions between E. N. E. and N. N. E. In North Bengal and Behar the winds were from the east, the normal direction during the south-west monsoon.

The air was now almost saturated in East and South-West Bengal and Orissa. Humidity had also increased very considerably over the

remainder of the Province, more especially in South Behar and Chutia Nagpore. The skies were overcast, or densely clouded, in all parts of the Province, except North Bengal and Behar.

Orissa again received very heavy rain. The following table gives the amounts recorded at all the reporting stations during the 24 hours preceding 6 p. m. of this day :—

| District.   | Stations.       | Rainfall. |
|-------------|-----------------|-----------|
| Pooree..... | Pooree ...      | 9.44      |
|             | Khurdah         | 7.96      |
|             | Banpur ...      | 3.46      |
|             | False Point ... | 5.39      |
|             | Hookitola.....  | 4.48      |
| Cuttack     | Jagatsingpore   | 4.90      |
|             | Banki .....     | 6.40      |
|             | Cuttack .....   | 5.61      |
|             | Kendrapara ...  | 3.60      |
|             | Jajpore .....   | 1.98      |
|             | Chandbali ..... | 4.15      |
| Balasore    | Bhuddruck ...   | 0.93      |
|             | Sora .....      | 1.60      |
|             | Balasore .....  | 2.65      |
|             | Jellasure ..... | 5.00      |
|             | Baripoda .....  | 1.60      |

General rain, moderate to heavy in amount, fell in East Bengal, South-West Bengal, and Chutia Nagpore, and local showers in North Bengal. No rain of any importance fell in Behar.

The following table gives the average rainfall for the preceding 24 hours in the various divisions of the Province of Bengal, and indicates the distribution at this time :—

*Rainfall Table of the 29th June, 1883.*

| Division.                                        | Number of stations in each province. | Average rainfall of 24 hours. | Heaviest fall in 24 hours. |
|--------------------------------------------------|--------------------------------------|-------------------------------|----------------------------|
| Orissa.....                                      | 16                                   | 4.32                          | 9.44                       |
| South-West Bengal.....                           | 46                                   | 0.65                          | 3.76                       |
| East Bengal .....                                | 26                                   | 1.59                          | 5.50                       |
| North Bengal .....                               | 27                                   | 0.24                          | 2.97                       |
| North Behar .....                                | 16                                   | 0.03                          | 0.25                       |
| South Behar .....                                | 17                                   | ...                           | 0.02                       |
| Sonthal Pergannahs and }<br>Chutia Nagpore ..... | 16                                   | 0.25                          | 1.54                       |

| Vessel.         | Hour.   | Latitude.<br>N.           | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Wind.           |         | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------|---------|---------------------------|------------------|---------------------------------------|-----------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |         |                           |                  |                                       | Direc-<br>tion. | Force.  |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Bancoora        | 4 A. M. |                           |                  | 29.597                                | S. W.           | 5       | Strong increasing breeze and puffy. Lightning in N. W. Strong unsteady wind and squally. Strong breeze and squally. Fresh following wind and overtast. Strong breeze with hard squalls through-out.                                                                                                                                                                                                                                |
|                 | 8 A. M. |                           |                  | .666                                  | S. W.           | 5       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Noon    | 18° 40'                   | 86° 58'          | .666                                  | S. W.           | 5       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 4 P. M. |                           |                  | .517                                  | S. W.           | 5       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 8 P. M. |                           |                  | .517                                  | S. W.           | 4       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Midnt.  |                           |                  | .495                                  | S. W.           | 5       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Pemba ...       | 4 A. M. |                           |                  | 29.420                                | S. W.           | 10      | A. M. Fierce gale with high irregular sea and hard squalls blowing with hurricane violence. 1 A. M. Kept away course again (N. 51 W.) 5 A. M. Lay to again. 9 A. M. Kept away course again, sea breaking over the ship fore and aft. 9-15 A. M. Laid to. 0.30 P. M. Course again. 3 P. M. Hauled to the wind again. 5 P. M. Kept away course again. 10-20 P. M. Sea becoming confused; weather inclined to moderate, sky clearing. |
|                 | 8 A. M. |                           |                  | .470                                  | W. S. W.        | 10      |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Noon    | 19° 16'                   | 89° 56'          | .500                                  | S. W.           | 9       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 4 P. M. | Rangoon towards Calcutta. |                  | .450                                  | ..              | 9       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 8 P. M. |                           |                  | .500                                  | ...             | 9       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Midnt.  |                           |                  | .530                                  | .               | 7       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Star of Albion. | 8 A. M. |                           |                  | 29.520                                | W. S. W.        |         | Hard gale and heavy sea, thick continued rain.                                                                                                                                                                                                                                                                                                                                                                                     |
|                 | Noon    | 19° 43'                   | 88° 37'          | .530                                  | S. W.           | 9 to 10 |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 4 P. M. |                           |                  | .520                                  |                 |         |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 8 P. M. |                           |                  | .570                                  |                 | 9 to 10 |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Midnt.  |                           |                  | .550                                  | S. W.           |         |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Saint Magnus.   | 4 A. M. |                           |                  | 29.230                                | W. S. W.        | 10      | Weather, more moderate and less rain. Heavy gale with terrific gusts, heavy sea, and continued heavy rain. Heavy squalls, rain, and high sea. Dirty appearance and heavy gusts.                                                                                                                                                                                                                                                    |
|                 | 8 A. M. |                           |                  | .300                                  | W. S. W.        | 10      |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Noon    | 19° 58'                   | 88° 28'          | .370                                  | W. S. W.        | 10      |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 4 P. M. |                           |                  | .380                                  | S. S. W.        | 9       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | 8 P. M. |                           |                  | .430                                  | S. S. W.        | 8       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                 | Midnt.  |                           |                  | .340                                  | S. S. W.        | 8       |                                                                                                                                                                                                                                                                                                                                                                                                                                    |



| Vessel.               | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Wind.             |        | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------|---------|-----------------|------------------|---------------------------------------|-------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |         |                 |                  |                                       | Direc-<br>tion.   | Force. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Prince<br>Amadeo.     | 4 A. M. |                 |                  |                                       | W. to<br>S. S. W. | 8      | Morning. Strong gale,<br>furious squalls.<br>Sharp vivid light-<br>ning, wild unsettled<br>appearance. Noon.<br>Strong gale, heavy<br>squalls, sea high and<br>very confused. Even-<br>ing. Similar wind<br>and weather.                                                                                                                                                                                                                                          |
|                       | Noon    | 20° 00'         | 88° 55'          | 29.320                                | S. W.             | to     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Midnt.  |                 |                  |                                       | S. W.             | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Commilla              | 4 A. M. |                 |                  | 29.190                                | S. W.             | 11     | 4 A. M. Terrific storm,<br>continual rain, and<br>furious squalls. 8 A. M.<br>Squalls of hurricane<br>force. Mountainous<br>sea. Noon. Very high<br>and dangerous sea<br>running; both an-<br>chors lifted out of<br>catchhooks, breaking<br>one stock. 4 P. M.<br>Wind and sea<br>slightly moderating.<br>Violent squalls from<br>S. W. 8 P. M. Sky<br>overhead clearing<br>at times; very dark<br>wild squally wea-<br>ther. Very heavy<br>rain in the squalls. |
|                       | 8 A. M. |                 |                  | 247                                   | S. W.             | 11     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Noon    | 20° 18'         | 88° 40'          | 252                                   | S. W.             | 11     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 4 P. M. |                 |                  | 232                                   | S. W.             | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 8 P. M. |                 |                  | 237                                   | S. W.             | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Midnt.  |                 |                  | 234                                   | S. W.             | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| British<br>Princess   | 4 A. M. |                 |                  |                                       | S. W. by S.       | 11     | Torrents of rain.<br>High confused sea.<br><br>Westerly gale.<br><br>Sea very high.                                                                                                                                                                                                                                                                                                                                                                               |
|                       | 8 A. M. |                 |                  |                                       |                   | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Noon    | 20° 24'         | 88° 42'          | 29.340                                |                   | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 4 P. M. |                 |                  |                                       |                   | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 8 P. M. |                 |                  |                                       | S. W.             | 9      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Scottish<br>Chieftain | Midnt.  |                 |                  |                                       | ...               | 9      | Lost fore topsail, laid<br>ship to under close<br>reefed main topsail.<br><br>Heavy rain and con-<br>fused sea. Very<br>strong westerly cur-<br>rent.                                                                                                                                                                                                                                                                                                             |
|                       | 4 A. M. |                 |                  |                                       | W. S. W.          | 10.    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 8 A. M. |                 |                  | 29.250                                | ...               | 11     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Noon    | 20° 40'         | 88° 10'          | 300                                   | ...               | 10     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 4 P. M. |                 |                  | 350                                   | ...               | 8      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | 8 P. M. |                 |                  |                                       | ...               | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Midnt.  |                 |                  | 400                                   | S. W.             | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

The various observations enable the centre of the barometric depression to be determined very approximately at 10 A. M. and at noon of the 29th. The wind directions at 10 A. M. observed on board the Light Vessels at the Upper Gasper and Intermediate stations were south-east and west, and hence the centre was between these vessels. Its position as determined by charting the wind directions and barometric heights was Lat.  $21^{\circ} 30' N.$  and Long.  $87^{\circ} 55' E.$

The following table gives the chief observations taken at the light vessels and neighbouring land stations at 10 A. M., and the distance and bearing of the centre from each of them.

|                               | Position.        |                  | Barom. | Winds.     |           |          | Distance. |
|-------------------------------|------------------|------------------|--------|------------|-----------|----------|-----------|
|                               | Latitude.<br>N.  | Longitude.<br>E. |        | Direction. | Force.    | Bearing. |           |
| Saugor Island Light House.    | $21^{\circ} 30'$ | $88^{\circ} 5'$  | 29.146 | E.         | Moderate. | S. W.    | 14        |
| Upper Gasper Light Vessel.    | $21^{\circ} 31'$ | $88^{\circ} 3'$  | 29.140 | S. E.      |           | W.       | 8         |
| Intermediate Light Vessel.    | $21^{\circ} 15'$ | $88^{\circ} 11'$ | 29.164 | W.         |           | N. W.    | 24        |
| Eastern Channel Light Vessel. | $21^{\circ} 1'$  | $88^{\circ} 12'$ | 29.199 | W. S. W.   | 8 to 9    | N. W.    | 38        |
| Balasoro ...                  | $21^{\circ} 30'$ | $86^{\circ} 58'$ | 29.296 | N. N. W.   | 8         | E.       | 60        |
| False Point                   | $20^{\circ} 20'$ | $86^{\circ} 47'$ | 29.419 | W. S. W.   | Strong    | N. E.    | 110       |

The nearest light-vessels were between 5 and 25 miles from the centre in the eastern quadrant, and yet experienced very moderate winds of force 5 to 6, whilst the Pemba and Commillah, at much greater distances in the same quadrant, had winds of force 9 to 11.

The unusual weakness of the winds in all quadrants near the centre, as compared with those in the south-eastern quadrant at considerable distances from the centre, is a remarkable fact, and one that is opposed to the general experience of cyclonic motion.

The noon barometric readings and wind directions of the ships, when charted, indicate that the centre was at that hour probably in Lat.  $21^{\circ} 30' N.$  and Long.  $87^{\circ} 50' E.$  It had moved about five miles to the west during the previous two hours.

The following table gives the distance and bearing of the centre from each of the vessels at that hour :—

|                            | Position.       |                  | Barometer. | Wind.          |           | Direction of centre. | Distance from probable position of centre. |
|----------------------------|-----------------|------------------|------------|----------------|-----------|----------------------|--------------------------------------------|
|                            | Latitude.<br>N. | Longitude.<br>E. |            | Direction.     | Strength. |                      |                                            |
| Saugor Island Light House. | 21° 39'         | 88° 5'           | 29.146     | E.             | Moderate. | S. W.                | 19                                         |
| Commillah .....            | 20° 18'         | 88° 40'          | 29.252     | S. W.          | 11        | N. W.                | 100                                        |
| Scottish Chieftain         | 20° 40'         | 88° 10'          | 29.300     | W. S. W.       | 10        | N. N. W.             | 60                                         |
| Saint Magnus .....         | 19° 58'         | 88° 28'          | 29.370     | W. S. W.       | 10        | N. N. W.             | 115                                        |
| British Princess ..        | 20° 24'         | 88° 42'          | 29.340     | S. W. by S.    | 10        | N. W.                | 95                                         |
| Prince Amadeo .....        | 20° 00'         | 88° 55'          | 29.320     | W. to S. S. W. | 8 to 10   | N. W.                | 125                                        |
| Star of Albion ...         | 19° 43'         | 88° 37'          | 29.53      | S. W.          | 9 to 10   | N. N. W.             | 145                                        |
| Pemba ... ..               | 19° 16'         | 89° 56'          | 29.50      | S. W.          | 9         | N. W.                | 200                                        |

The preceding table shows that the vessels were all in the south eastern quadrant. They were experiencing violent west to south-west winds with frequent squalls of hurricane force. The majority of them were for the first time feeling the full strength of the storm.

The storm continued to pass to the westward during the day. The centre was probably in Lat. 21° 35' N. and Long. 87° 30' E. at 4 P. M.

The observations taken at the light-vessels and the neighbouring land stations, with the probable distance and bearing of the centre from each, are given below :—

|                               | Position.       |                  | Baro.  | Wind.       |             | Direction of centre. | Distance from probable position of centre. |
|-------------------------------|-----------------|------------------|--------|-------------|-------------|----------------------|--------------------------------------------|
|                               | Latitude.<br>N. | Longitude.<br>E. |        | Direction.  | Strength.   |                      |                                            |
| Calcutta (Alipore)            | 22° 32'         | 88° 20'          | 29.214 | E.          | Strong      | S. W.                | 85                                         |
| Burdwan .....                 | 23° 14'         | 87° 54'          | 29.245 | N. E.       | Light       | S. W.                | 115                                        |
| False Point .....             | 20° 20'         | 86° 47'          | 29.361 | W. S. W.    | Strong      | N. N. E.             | 98                                         |
| Cuttack .....                 | 20° 29'         | 85° 54'          | 29.285 | W. N. W.    | Light       | N. E.                | 130                                        |
| Saugor Island Light House.    | 21° 39'         | 88° 5'           | 29.112 | S. W.       | Very strong | W.                   | 38                                         |
| Upper Gasper Light Vessel.    | 21° 31'         | 88° 3'           | 29.108 | S. W.       | 9           | W.                   | 36                                         |
| Intermediate Light Vessel.    | 21° 15'         | 88° 11'          | 29.199 | S. W.       | 9           | W. N.                | 50                                         |
| Eastern Channel Light Vessel. | 21° 1'          | 88° 12'          | 29.237 | S. W. by W. | 8 to 9      | W. N. W.             | 60                                         |

The preceding observations show that the light-vessels were now experiencing very strong south-westerly winds, and that frequent severe squalls passed over them.

The remarkable difference between the force of the south-westerly winds at distances of more than 30 miles from the centre and the winds from other directions and also the winds near the centre, is shown very conclusively by the Saugor Island observations. The greatest amount of wind, as registered by the anemometer at that station in any interval of two hours between 1 P. M. of the 28th and 3 P. M. of the 29th, was 23 miles. The amount recorded between 1 P. M. and 3 P. M. of the 29th, when very variable and steady winds were blowing, was only 5 miles. Between 3 P. M. and 5 P. M., during which hours south-west winds prevailed, 78 miles of wind were recorded, and between 5 P. M. and 7 P. M., 46 miles. During this period, a severe gale of wind blew from the south, and gave rise to a tremendous sea.

The position of the centre has been deduced from the various observations. It moved during the day almost due westwards, parallel to the coast of the Sunderbunds. The vessels bound for Calcutta, which were approaching the entrance to the Hooghly, were almost without exception in the eastern quadrant during the day. Their logs describe the force of the south-westerly winds in this part of the whirl in very similar language.

The Commillah, in Lat.  $20^{\circ} 18'$  N. Long.  $88^{\circ} 40'$  E. at noon, had terrific gales, with continual rain and furious squalls, in the morning. Squalls of hurricane force passed over the steamer. A tremendous and dangerous sea was running. South-westerly winds of average force 11 obtained during the morning. The wind and weather slightly moderated during the afternoon, but violent squalls continued to come up from the south-west, bringing very heavy rain.

The Pemba, 100 miles to the S. E. of the Commillah, experienced a fierce gale with hard squalls blowing with hurricane violence. No improvement occurred in the weather until late in the evening, when the sky began to clear and the sea to moderate a little.

The Star of Albion and the Scottish Chieftain experienced similar weather. The log of the Saint Magnus (in Lat.  $19^{\circ} 58'$  N. Long.  $88^{\circ} 28'$  E. at noon) describes the weather in the morning as a heavy gale with terrific gusts and continued heavy rain. The Captain of the British Princess (in Lat.  $20^{\circ} 24'$  N. and Long.  $88^{\circ} 42'$  E. at noon) notes that the wind decreased from force 11 in the morning to force 9 in the evening, and that torrents of rain fell during the morning. The wind blew steadily from the south-west quarter, and brought up a very high sea.

The Captain of the Comet speaks as follows of the weather on the 29th: "Weather was very threatening. A heavy sea came up from the south-east; the wind was very variable, shifting all round the compass. Rain squalls frequently came up. At midnight it was blowing a furious gale."

The Captain of the Meteor remarks of the weather he experienced during the day: "The sea was very rough and a high squall from south-west came up at 8 A. M. Frequent heavy rain-squalls passed over the vessel. The wind shifted to south-west at 10.30 A. M. The barometer began to rise at 2 P. M. During the evening a strong south-west gale blew, and frequent terrific rain-squalls passed over the vessel. At 11 P. M. the wind began to decrease in force and the squalls were less frequent."

30th June.—The depression off the mouth of the Hooghly on the 29th had travelled in a westerly direction, crossed the coast near Bala-sore, and passed westward to the north of Cuttack.

The depression was apparently smaller than on the previous day, the lowest recorded reading of the barometer at 10 A. M. being 29.35". It was, however, a well-marked depression of about a quarter of an inch at the centre. The westward motion of the disturbance caused the barometer to fall briskly at Cuttack and in the adjacent districts of Chutia Nagpore and the Central Provinces, whilst, over the whole of Bengal, a very rapid recovery of pressure occurred. The wind directions in North-Eastern India indicated the continuance of cyclonic circulation in Bengal, Orissa, the Central Provinces, and Chutia Nagpore. Winds were from west in Orissa, south to east in Bengal, north in Chutia Nagpore, and north-west in the Central Provinces.

In other parts of India, the barometer rose generally during the preceding 24 hours. The changes over the greater part of the North Western Provinces and Bombay slightly exceeded a tenth of an inch, but the relative distribution of pressure was unaltered, except in Bengal and Orissa. The wind on the Bombay Coast had veered again to south-west, and was moderating. Very cloudy skies prevailed over the whole of Northern India. Heavy rain showers had fallen in the North-Western Provinces, and diminished the temperature over a large portion of Upper India from 10° to 15°.

Heavy rain continued to fall in connection with the cyclonic vortex in Orissa and the western districts of the Central Provinces.

The preceding remarks are illustrated by the following observations:—

| STATIONS.          | Barometer<br>10<br>A. M. red<br>to<br>sea level | Change since 1<br>A. M. previous<br>day. | Wind.    |          | Wind velocity in<br>miles per hour<br>since 10 A. M.<br>previous day. | Age |
|--------------------|-------------------------------------------------|------------------------------------------|----------|----------|-----------------------------------------------------------------------|-----|
|                    |                                                 |                                          | 10 h.    | 16 h.    |                                                                       |     |
| Nancowry .....     | 29.912                                          | — .002                                   | S. W.    | S. W.    | 10                                                                    | 91  |
| Port Blair .....   | 29.846                                          | — .029                                   | S. W.    | S. W.    | 12                                                                    | 109 |
| Diamond Island ... | 29.832                                          | — .003                                   | S. S. W. | S. W.    | 9                                                                     | 113 |
| Akyab .....        | 29.776                                          | + .081                                   | S. S. E. | S.       | 7                                                                     | 175 |
| Chittagong .....   | 29.758                                          | + .150                                   | E.       | E.       | 9                                                                     | 129 |
| Dacca .....        | 29.684                                          | + .154                                   | S. E.    | S.       | 12                                                                    | 150 |
| Jessore .....      | 29.645                                          | + .200                                   | E. S. E. | S. E.    | 21                                                                    | 420 |
| Calcutta (Alipore) | 29.555                                          | + .233                                   | S. E.    | S. S. E. | 16                                                                    | 267 |
| Sangor Island ...  | 29.517                                          | + .344                                   | S. E.    | S. E.    | 19                                                                    | 136 |
| Balasore .....     | 29.433                                          | + .078                                   | S.       | ?        | 14                                                                    | 737 |
| Cuttack .....      | 29.382                                          | — .086                                   | W.       | W. N. W. | 10                                                                    | 250 |
| False Point .....  | 29.444                                          | + .004                                   | S.       | S.       | 24                                                                    | 240 |
| Vizagapatam .....  | 29.618                                          | + .005                                   | W.       | W. by S. | 6                                                                     | 150 |

The following observations taken at stations in and near the area of cyclonic disturbance on the morning (10 A. M.) of 30th June give data for the determination of the storm centre at that hour:—

| STATION.            | Barometer<br>at<br>10<br>A. M.<br>sea level | Change since 10<br>A. M. previous<br>day. | Wind.    | Amount in<br>miles per<br>hour since<br>10 A. M. pre-<br>vious day. | Cloud amount<br>10 A. M. | Age<br>A. M. of pre-<br>vious day |
|---------------------|---------------------------------------------|-------------------------------------------|----------|---------------------------------------------------------------------|--------------------------|-----------------------------------|
|                     |                                             |                                           |          |                                                                     |                          |                                   |
| Sangor Island ..... | 29.517                                      | + .344                                    | S. E.    | 19.0                                                                | 10                       | 0.36                              |
| Calcutta .....      | 29.556                                      | + .233                                    | S. E.    | 16.0                                                                | 10                       | 1.17                              |
| Burdwan .....       | 29.546                                      | + .121                                    | E.       | 12.0                                                                | 10                       | 0.88                              |
| Hazaribagh .....    | 29.518                                      | — .027                                    | E. N. E. | 18.0                                                                | 10                       | 0.38                              |
| Jubbulpore .....    | 29.686                                      | + .042                                    | W. N. W. | 6.0                                                                 | 10                       | 0.45                              |
| Seoni .....         | 29.665                                      | + .002                                    | N. W.    | 5.0                                                                 | 6                        | 0.45                              |
| Nagpur .....        | 29.674                                      | + .017                                    | N. W.    | 9.0                                                                 | 10                       | ...                               |
| Raipore .....       | 29.512                                      | — .087                                    | W.       | 20.8                                                                | 10                       | 1.28                              |
| Sambalpore .....    | 29.353                                      | — .111                                    | S. W.    | 3.3                                                                 | 10                       | 4.74                              |
| Cuttack .....       | 29.382                                      | — .086                                    | W.       | 10.0                                                                | 10                       | 4.08                              |
| False Point .....   | 29.444                                      | + .004                                    | S.       | 24.0                                                                | 9                        | 1.47                              |

The observations indicate that the cyclonic area extended over Orissa and the north-eastern districts of the Central Provinces, and that the centre was in the neighbourhood of Sambalpore and to the north-west. The probable position of the centre at 10 A. M. was Lat.  $21^{\circ} 45'$  N. and Long.  $83^{\circ} 50'$  E.; and the barometric height there was almost certainly not lower than  $29.3''$ . It had consequently crossed over the Northern Orissa Hills (in the Hill States of Morbhanj, Keunjhar, and Pal Lahara), the average height of which appear to be about 2000 ft., and the highest points of which slightly exceed 3,500 ft. This area is described in the following language by Dr. Hunter in his Statistical Account of the Orissa States:—"From the north bank of the Mahanad<sup>e</sup>, the ranges tower into a fine watershed, from 2000 to 2500 feet high, running north-west and south-east, and forming the boundary of the States of Nursingpore and Baramba. On the other side, they slope down upon the States of Hindol and Dhenkanal supplying countless little feeders to the Brahmani, which occupies the second of the three valleys. From the north bank of this river, the hills again roll back into magnificent ranges, running in the same general direction as before, but more confused and wilder, till they rise into the Keunjhar watershed, with peaks from 2500 to 3500 feet high, culminating in Malayagiri, 3,895 feet high, in the State of Pal Lahara. This watershed, in turn, slopes down into the third valley, that of the Baitarani, from whose eastern or left bank rise the hitherto almost unexplored mountains of Morbhanj, heaped upon each other in noble masses of rock, from 3,000 to nearly 4,000 feet high, sending countless tributaries to the Baitarani on the south, and pouring down the Burabalang, with the feeders of the Subarnarekha, on the north. The peaks are densely wooded to the summit, and, except at the regular passes, are inaccessible to beasts of burden. The intermediate valleys yield rich crops in return for negligent cultivation; and a vast quantity of land might be reclaimed on their outskirts and lower slopes."

Hence, during the interval between 4 P. M. of the 29th and 10 A. M. of the 30th, the centre of the storm had crossed the Balasore coast, been transferred across the very broken and elevated ground of the North Orissa Hills, and was at 10 A. M. of the 30th in the direct line of its advance previous to crossing the hills. What actions occurred during its passage across this hilly country are unknown, but it is certain that they produced no appreciable resultant effect on the line of motion of the vortex, and only a very moderate one on the depression at the centre. This was  $29.3''$  at 10 A. M. of the 30th, as compared with  $29.14''$  at 10 A. M. of the 29th. There can be little doubt that the effect of the irregular character of the country would be to break up and disintegrate the cyclonic or rotatory motion in the lower atmospheric strata, or to dimi-

nish as a whole the intensity and amount of the cyclonic motion, and, therefore, also of the depression at the centre, which roughly measures the intensity of the disturbance.

The observations taken at 4 P. M. in the neighbourhood of the centre are given in the following table :—

| Station.         | Barometer<br>P. M. read<br>sea level. | Change since 4<br>P. M. previous<br>day. | Direct<br>at 4 P. | Wind.<br><br>Amount in<br>miles per<br>hour since<br>10 A. M. | Cloud<br>amount at 4 P. M |
|------------------|---------------------------------------|------------------------------------------|-------------------|---------------------------------------------------------------|---------------------------|
| Sangor Island    | 29.508                                | + .371                                   | S. E.             | 20.0                                                          | 10                        |
| Burdwan ...      | .516                                  | + .172                                   | S. E.             | 12.0                                                          | 9                         |
| Hazaribagh ...   | .446                                  | — .001                                   | E.                | 22.9                                                          | 10                        |
| Sutna.....       | .533                                  | + .013                                   | E. N. E.          | 24.5                                                          | 6                         |
| Jubbulpore ..... | .538                                  | — .033                                   | N. W.             | 24.8                                                          | 10                        |
| Seoni.....       | .543                                  | — .038                                   | W. N. W.          | 24.4                                                          | 5                         |
| Nagpur .....     | .546                                  | + .007                                   | N. W.             | 12.2                                                          | 10                        |
| Raipore .....    | .415                                  | — .084                                   | W.                | 60.0                                                          | 10                        |
| Sambalporo ...   | .215                                  | — .122                                   | S. W.             | 1.5                                                           | 10                        |
| Cuttack .....    | .395                                  | + .029                                   | W. N. W.          | 65.0                                                          | 10                        |

In comparing these observations with the preceding 10 A. M. observations, it should be remembered that the fall of the barometer between 10 A. M. and 4 P. M., due to the diurnal oscillation, is .11" during the months of June and July in the Central Provinces. Hence, making allowance for this, it will be seen that the barometric changes due to the storm were of the following character. Pressure had increased about .08" at Cuttack and .11" at Hazaribagh, and had fallen .03" at Sambalporo. It had, consequently, risen during the previous six hours at all stations in the immediate neighbourhood of its centre, except Sambalporo, the nearest station. These facts appear to establish in this case that which I believe, from an examination of other similar cyclonic disturbances, to be a general result of the advance of a storm over a hilly country, *viz.*, that the storm tends to break up, the cyclonic motion becoming more irregular, and the barometric depression smaller in amount over the greater part, if not the whole, of the area of cyclonic circulation, but fre-



quently extending over a larger area. In other words, the cyclonic action becomes less intense and more diffuse, which is probably the first step in the disintegration of cyclonic disturbances. On the other hand, if, after its passage across hills, it receives increased energy and again intensifies, this is usually indicated by a contraction of the storm area, and by an increase of the depression near the centre.

The position of the centre at 4 P. M. was apparently almost identical with that in which it had been at 10 A. M., and was, so far as can be inferred from the observations, in Lat.  $21^{\circ} 50' N.$  and Long.  $83^{\circ} 30' E.$ , or about 20 miles to the west of its position at 10 A. M.

The rainfall during the previous 24 hours in Orissa and Chutia Nagpur is given in the following table:—

| DIVISION.         | Districts.         | Average rainfall of district. | Highest rainfall in district. |
|-------------------|--------------------|-------------------------------|-------------------------------|
| Orissa            | Pooree .....       | 1.83                          | 3.88                          |
|                   | Cuttack.....       | 2.07                          | 3.21                          |
|                   | Balasore... ..     | 3.02                          | 5.64                          |
| Chhattisgarh .... | Bilaspore .....    | 0.51                          | 2.54                          |
|                   | Sambalpur .....    | 1.17                          | 4.08                          |
|                   | Raipore .....      | 1.30                          | 2.03                          |
| Nagpur            | Wardha .....       | 1.82                          | 2.71                          |
|                   | Bhundara.....      | 2.71                          | 4.54                          |
|                   | Balaghat .....     | 0.03                          | 0.10                          |
|                   | Nagpur .....       | nil.                          | nil.                          |
| Jubbulpore .....  | Jubbulpore .....   | 0.54                          | 0.65                          |
|                   | Seoni .....        | 0.73                          | 2.09                          |
|                   | Mandla .....       | 6.26                          | 1.81                          |
|                   | Damoh .....        | 0.26                          | 0.90                          |
|                   | Saugor .....       | 0.03                          | 0.11                          |
| Nerbudda          | Narsinghpore ..... | 0.88                          | 3.00                          |
|                   | Chhindwara .....   | 1.03                          | 4.09                          |
|                   | Betul.....         | 0.43                          | 2.83                          |
|                   | Hoshangabad .....  | 0.01                          | 0.05                          |
|                   | Nimar .....        | nil.                          | nil.                          |

The meteorological information extracted from the logs of vessels at the Head of the Bay on the 30th is given to show the improvement in the weather, and the establishment of southerly winds over the Head of the Bay.

30th June 1883.

| Vessel.                 | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Wind.    |        | REMARKS.                                                                                                           |
|-------------------------|---------|-----------------|------------------|---------------------------------------|----------|--------|--------------------------------------------------------------------------------------------------------------------|
|                         |         |                 |                  |                                       | Dir.     | Force. |                                                                                                                    |
| Bancoora ..             | 4 A. M. |                 |                  | 29.552                                | S. W.    | 5      | Strong wind and over-<br>cast.                                                                                     |
|                         | 8 A. M. |                 |                  | .539                                  | S. W.    | 3      | Moderate breeze and<br>fine throughout.                                                                            |
|                         | Noon    | 20° 01'         | 88° 25'          | .542                                  | S. W.    | 3      | Do. do. do.                                                                                                        |
|                         | 4 P. M. |                 |                  | .638                                  | S.       | 3      | Current 80 miles ad-<br>verso.                                                                                     |
|                         | 8 P. M. |                 |                  | .539                                  | S.       | 3      | Moderate breeze and<br>fine.                                                                                       |
|                         | Midnt.  |                 |                  | .552                                  | S.       | 3      | Moderate and fine at<br>Saugor.                                                                                    |
| Star of Al-<br>bion ... | 4 A. M. |                 |                  | 29.540                                |          |        | Gale moderating, wea-<br>ther finer and less<br>sea.                                                               |
|                         | 8 A. M. |                 |                  | .570                                  |          |        |                                                                                                                    |
|                         | Noon    | 20° 15'         | 87° 28'          | .610                                  | S. S. W. | 6 to 4 |                                                                                                                    |
|                         | 4 P. M. |                 |                  | .620                                  | S.       |        | Latter part much finer.                                                                                            |
|                         | 8 P. M. |                 |                  | .670                                  |          |        |                                                                                                                    |
|                         | Midnt.  |                 |                  | .670                                  |          |        |                                                                                                                    |
| Saint Mag-<br>nus ..... | 4 A. M. |                 |                  | 29.440                                | S. S. W. | 8      | Squally rainy weather,<br>heavy sea.                                                                               |
|                         | 8 A. M. |                 |                  | .490                                  | S. S. W. | 7      | Do. do. do.                                                                                                        |
|                         | Noon    | 20° 32'         | 87° 56'          | .470                                  | S. S. W. | 6      | Strong breeze, cloudy<br>hazy weather.                                                                             |
|                         | 4 P. M. |                 |                  | .490                                  | S.       | 5      | Cloudy rainy weather,<br>nasty sea.                                                                                |
|                         | 8 P. M. |                 |                  | .570                                  | S.       | 4      | Moderate and fine.                                                                                                 |
|                         |         |                 |                  |                                       |          |        |                                                                                                                    |
| Scottish<br>Chieftain   | 4 A. M. |                 |                  | 29.450                                | S. W.    | 5      | Weather having a<br>much finer look, and<br>barometer rising, are<br>proofs that the strong<br>winds are now over. |
|                         | 8 A. M. | 20° 50'         |                  | .500                                  |          | 4      | A very strong wester-<br>ly current.                                                                               |
|                         | Noon    | 20° 32'         | 87° 34'          | .430                                  |          | 3      |                                                                                                                    |
|                         | 4 P. M. |                 |                  | .580                                  |          | 1      |                                                                                                                    |
|                         | 8 P. M. |                 |                  | .620                                  |          | 1      |                                                                                                                    |
|                         | Midnt.  |                 |                  | .680                                  |          |        |                                                                                                                    |
| Pemba ...               | 4 A. M. |                 |                  | 29.490                                | S. W.    | 6      | A. M. Strong breeze,<br>sea going down.                                                                            |
|                         | 8 A. M. |                 |                  | .540                                  | ...      | 6      |                                                                                                                    |
|                         | Noon    | 20° 33'         | 88° 31'          | .540                                  | ...      | 5      | Noon. Moderate breeze<br>and clear.                                                                                |
|                         | 4 P. M. |                 |                  | .520                                  | ...      | 5      | 3.45 P. M. Passed E.<br>Channel Light Vessel,                                                                      |
|                         | 8 P. M. |                 |                  | .580                                  | ...      | 5      | 8 P. M. Anchored in<br>Saugor Roads.                                                                               |
|                         | Midnt.  |                 |                  | .600                                  | ...      | 5      |                                                                                                                    |

| Vessel.          | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Wind.    |        | REMARKS.                                                                                                                                                                                                                                                                                                                          |
|------------------|---------|-----------------|------------------|---------------------------------------|----------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  |         |                 |                  |                                       | Dir.     | Force. |                                                                                                                                                                                                                                                                                                                                   |
| British Princess | 4 A. M. |                 |                  |                                       |          | 9      | Squally with rain.                                                                                                                                                                                                                                                                                                                |
|                  | 8 A. M. |                 |                  |                                       |          | 9      | Sea very high.                                                                                                                                                                                                                                                                                                                    |
|                  | Noon    | 20° 33'         | 88° 19'          | .                                     |          | 8      | Sea very high.                                                                                                                                                                                                                                                                                                                    |
|                  | 4 P. M. |                 |                  |                                       |          | 8      |                                                                                                                                                                                                                                                                                                                                   |
|                  | 8 P. M. |                 |                  |                                       |          | 6      | Sea very high.                                                                                                                                                                                                                                                                                                                    |
|                  | Midnt.  |                 |                  |                                       |          | 5      | High confused sea.                                                                                                                                                                                                                                                                                                                |
| Prince Amadeo    | 4 A. M. |                 |                  |                                       | S. S. W. | 10     | Midnight. Gale break-<br>ing.                                                                                                                                                                                                                                                                                                     |
|                  | Noon    | 20° 39'         | 88° 20'          | 29.530                                | S.       | 8      |                                                                                                                                                                                                                                                                                                                                   |
|                  | 8 P. M. |                 |                  |                                       |          | 5      | 4 A. M. Strong S. S.<br>W., occasional heavy<br>squalls.                                                                                                                                                                                                                                                                          |
|                  | Midnt.  |                 |                  |                                       |          | 5      | Noon. Strong wind S.,<br>weather finer.                                                                                                                                                                                                                                                                                           |
|                  |         |                 |                  |                                       |          |        |                                                                                                                                                                                                                                                                                                                                   |
| Commillah        | 4 A. M. |                 |                  | 29.349                                | S. W.    | 9      | A. M. Hard squalls and<br>heavy rain and high<br>sea, stood to south-<br>ward. A very high<br>sea running from<br>S. W. 5 A. M. Stood<br>up to Northward.<br>Weather clearing at<br>times for observa-<br>tions. 8 A. M. Hard<br>squalls from S. W.<br>and high sea. Noon.<br>Overcast, weather<br>hazy. 4 P. M. Fine<br>weather. |
|                  | 8 A. M. |                 |                  | .423                                  | S. S. W. | 8      |                                                                                                                                                                                                                                                                                                                                   |
|                  | Noon    |                 |                  | .434                                  | S. S. W. | 7      |                                                                                                                                                                                                                                                                                                                                   |
|                  | 4 P. M. |                 |                  | .401                                  | S. W.    | 5      |                                                                                                                                                                                                                                                                                                                                   |
|                  | 8 P. M. |                 |                  | .464                                  | Var.     | 4      |                                                                                                                                                                                                                                                                                                                                   |
|                  | Midnt.  |                 |                  | .569                                  | E. S. E. | 3      |                                                                                                                                                                                                                                                                                                                                   |

The preceding observations call for little remark. They show that south-westerly winds were fully established over the whole of the north of the Bay, but that they were diminishing rapidly in force. Before sunset, moderate breezes and finer weather had set in. Heavy squalls came up during the early part of the day, but the only vessel which reports rain during the afternoon was the Saint Magnus. In her case, however, it is stated that the weather improved rapidly and was fine, with moderate winds, at 8 P. M. Hence, the stormy weather in the Bay ceased about noon of the 30th. A heavy swell continued to run for some little time afterwards, and strong westerly winds prevailed for the next 24 hours.

*July 1st.*—The following table gives the observations taken at a few of the most important stations, and indicates the general character of the weather over India on the morning of the 1st :—

| STATION.     | Wind.         |                        | at                                                                  |                | Weather.                 |
|--------------|---------------|------------------------|---------------------------------------------------------------------|----------------|--------------------------|
|              |               |                        | Amount in<br>miles per<br>hour since<br>10 A. M. pre-<br>vious day. | Cloud<br>10 A. |                          |
| C            | A. M.<br>day. | Direction.<br>10 A. M. |                                                                     |                |                          |
| Calcutta...  | 29·676        | + ·121                 | S. E.                                                               | 7              | 0·29 Fine.               |
| Allahabad .  | ·566          | — ·070                 | E. N. E.                                                            | 8              | ... Strong wind.         |
| Lahore ....  | ·701          | + ·212                 | N.                                                                  | 3              | 0·77 Dark, gloomy.       |
| Kurracheo.   | ·642          | + ·057                 | W. S. W.                                                            | 17             | 0·17 Sultry.             |
| Bombay .     | ·765          | — ·010                 | W.                                                                  | 17             | 0·21 Showery.            |
| Jeypore .... | ·678          | + ·032                 | N.                                                                  | 5*             | 0·74 Showery.            |
| Nagpur .     | ·471          | — ·203                 | W.                                                                  | 11             | 4·08 Continuous<br>rain. |
| Madras ....  | ·775          | — ·038                 | W.                                                                  | 8              | Fino.                    |
| Bangalore.   | ·803          | — ·042                 | S. W.                                                               | 11             | Fino.                    |

The observations of the 1st indicate that the barometric depression moved during that day in the same direction as hitherto and at a rate of about 15 miles per hour. The westward motion of the depression had caused a fall of nearly two-tenths of an inch in the barometer over the greater part of the Central Provinces, and a general, although a slight, decrease over the whole of the Peninsula and Bombay. In Bengal, the rapid recovery in progress on the 30th continued. A rapid rise had also occurred over the Punjab and the western districts of the North Western Provinces, due to some other and independent action. A very distinct circulation of the air was shown round the centre of depression. In the mid-Gangetic valley, the winds had drawn round to north-east, and, over the western portions of the Central Provinces, they were blowing from north-west. Moderately strong winds continued at the Head of the Bay and in South Bengal. No change of importance had occurred in the wind directions over Bombay and the south of the Peninsula. Strong west winds prevailed along the Bombay coast, where, however, little or no rain was falling. Local winds obtained in the Punjab. The sky was less clouded, the weather finer, and rainfall less in amount over the Gangetic delta and valley. The depression was, however, giving very heavy rain to the Central Provinces, where the sky was overcast. Over the remainder of the country, the weather was of the usual monsoon character.

The storm had advanced through the Chhatisgarh division of the Central Provinces (which includes the Sambalpoore, Bilaspore, and Raipore districts), and was now passing through the Jubbulpore and Nagpur divisions.

The following table gives the 10 A. M. observations at the stations in the neighbourhood of the centre at that hour:—

| STATION.       | Barometer at 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Wind.                  |                                                       | Cloud amount at 10 A. M. | Rainfall at 10 A. M. of preceding 24 hours. | Weather.         |
|----------------|---------------------------------------------|-------------------------------------|------------------------|-------------------------------------------------------|--------------------------|---------------------------------------------|------------------|
|                |                                             |                                     | Direction. at 10 A. M. | Amount in miles per hour since 10 A. M. previous day. |                          |                                             |                  |
| Sambalpoore .. | 29.526                                      | + .173                              | S. W.                  | 1.4                                                   | 6                        | 1.84                                        |                  |
| Raipore .....  | 535                                         | + .024                              | S. W.                  | 20.0                                                  | 10                       | ...                                         | Overcast.        |
| Hazaribagh ..  | 627                                         | + .109                              | E. S. E.               | 20.0                                                  | 8                        | 0.34                                        | Gale of wind.    |
| Sutna.....     | 534                                         | — .090                              | E.                     | 21.0                                                  | 10                       | 0.08                                        | Ditto.           |
| Seoni .....    | 463                                         | — .202                              | N. N. W.               | 15.0                                                  | 10                       | 4.60                                        | Continuous rain. |
| Jubbulpore ... | 483                                         | — .204                              | N. N. E.               | 8.0                                                   | 10                       | 1.82                                        | Moist & muggy.   |
| Nagpur ... ..  | 471                                         | — .203                              | W.                     | 11.0                                                  | 10                       | 4.08                                        |                  |

The number of observatories in Chutia Nagpore and the north-eastern districts of the Central Provinces is very small for their extent. Hence, it is not possible to state with approximate exactness the position of the centre of the depression at this time.

The observations, however, indicate that the centre was to the east of Seoni, and that it was at nearly equal distances from Jubbulpore, Seoni, and Nagpore, and hence almost certainly in Lat.  $22^{\circ}$  N. and Long.  $81^{\circ}$  E.

The following table gives the observations at 4 P. M. for the determination of the position of the centre at that hour:—

| STATION.      | Barometer at 4 P. M. reduced to sea level. | Change since 4 P. M. previous day. | Wind.                |                                         | Cloud amount at 4 P. M. | Weather.           |
|---------------|--------------------------------------------|------------------------------------|----------------------|-----------------------------------------|-------------------------|--------------------|
|               |                                            |                                    | Direction at 4 P. M. | Amount in miles per hour since 10 A. M. |                         |                    |
| Nagpur .....  | 29.355                                     | — .191                             | W.                   | 11.7                                    | 10                      | Overcast.          |
| Raipore ..... | 415                                        | — 0                                | S. W.                | 64.1                                    | 10                      | Overcast.          |
| Seoni .....   | 323                                        | — .220                             | E.                   | 9.2                                     | 10                      | Overcast, raining. |
| Sutna .....   | 435                                        | — .098                             | E.                   | 30.0                                    | 7                       |                    |
| Jubbulpore .. | 375                                        | — .163                             | E. N. E.             | 14.2                                    | 10                      | Gloomy.            |
| Saugor .....  | 412                                        | — .178                             | N. W.                | 2.3                                     | 8                       |                    |
| Hoshangabad   | 420                                        | — .153                             | W. S. W.             | 2.8                                     | 10                      | Overcast.          |
| Khandwa ..... | 478                                        | — .132                             | W. N. W.             | 20.1                                    | 10                      | Raining.           |
| Akola .....   | 509                                        | — .091                             | W. N. W.             | 21.0                                    | 10                      | Overcast.          |
| Indore .....  | 533                                        | — .073                             | W. N. W.             | 15.0                                    | 10                      | Overcast.          |

Allowing for the amount of the fall of the barometer between 10 A. M. and 4 P. M. due to the diurnal oscillation, the barometer had risen at Sambalpore '11"', and had also risen at Akola '02"'. The only portion of the area in which it had fallen was that represented by the station of Seoni, where it had fallen '03"'. .

The wind directions at Seoni and Nagpore were east and west respectively, and indicate that the centre was between these two stations, and probably some little distance to the east of the line joining them. Its probable position was hence in Lat. 22° N. and Long. 79° 45' E.

The following table gives the average rainfall during the previous 24 hours in every district of Orissa and the Central Provinces :—

| Division.    | District.       | Highest in district. |
|--------------|-----------------|----------------------|
| Orissa       | Pooree .....    | 0.05                 |
|              | Cuttack .....   | nil.                 |
|              | Balasore .....  | 0.20                 |
| Chattisgarh  | Sambalpore ..   | 5.25                 |
|              | Raipore .....   | 4.25                 |
|              | Bilaspore ..... | 2.92                 |
| Nagpore      | Bandhara .....  | 4.36                 |
|              | Balaghat ....   | 5.00                 |
|              | Nagpore .....   | 4.80                 |
|              | Wardha .....    | 4.18                 |
| Jubbulpore . | Jubbulpore ..   | 1.62                 |
|              | Seoni .....     | 5.65                 |
|              | Mandla .....    | 0.15                 |
|              | Damoh .....     | 0.80                 |
|              | Saugor .....    | 0.48                 |
| Nerbudda     | Nursinghpore    | 1.25                 |
|              | Chhindwara ..   | 4.90                 |
|              | Betul .....     | 6.13                 |
|              | Hoshangabad     | 5.99                 |
|              | Nimar .....     | 1.01                 |

This table indicates that rain had practically ceased to fall in Orissa, and that moderate rain had fallen in Chattisgarh. Heavy rain had been received in all districts of the Central Provinces through which the cyclone passed during the day, namely, the Seoni, Chhindwara, and Hoshang-

abad districts, and also in the districts to the south of the line of motion; whilst in the districts to the north the rainfall was light.

The following table shews that the amount of rain in Bengal was very small:—

| Districts.           | Average rain-fall of district. | Highest in district. |
|----------------------|--------------------------------|----------------------|
| Orissa .....         | 0.04                           | 0.20                 |
| South West Bengal    | 0.12                           | 0.96                 |
| East Bengal .....    | 0.09                           | 0.50                 |
| North Bengal .....   | 0.08                           | 1.37                 |
| North Behar .....    | nil.                           | 0.07                 |
| South Behar .....    | 0.05                           | 0.80                 |
| Chutia Nagpore ..... | 0.11                           | 0.46                 |

2nd July.—The following table gives the 10 A. M. observations of this day at the nine most important observatories in India.

| STATIONS.       | Barometer at 10<br>A. M. reduced to<br>sea level. | Change since 10<br>A. M. previous day. | Wind.      |                                                                     | Cloud<br>amount<br>at 10 A. M. | Rainfall at 10<br>A. M. of preced-<br>ing 24 hours. | Weather.          |
|-----------------|---------------------------------------------------|----------------------------------------|------------|---------------------------------------------------------------------|--------------------------------|-----------------------------------------------------|-------------------|
|                 |                                                   |                                        | Direction. | Amount in<br>miles per<br>hour since<br>10 A. M. pre-<br>vious day. |                                |                                                     |                   |
|                 |                                                   |                                        |            |                                                                     |                                |                                                     |                   |
| Calcutta .....  | 29.673                                            | — .003                                 | S. W.      | 4                                                                   | 8                              | 0.03                                                | Fine.             |
| Allahabad ..... | .613                                              | + .047                                 | E.         | 8                                                                   | 2                              | 0.04                                                | Strong wind.      |
| Lahore .....    | .590                                              | — .111                                 | W.         | 2                                                                   | 5                              | ...                                                 | Fine.             |
| Kurrachee.....  | .556                                              | — .086                                 | N. W.      | 18                                                                  | 2                              | ...                                                 | Fine.             |
| Bombay .....    | .708                                              | — .057                                 | W. S. W.   | 20                                                                  | 10                             | 0.15                                                | Showery.          |
| Jeyapore .....  | .541                                              | — .137                                 | E. S. E.   | 7                                                                   | 6                              | ...                                                 | Fine.             |
| Nagpore .....   | .621                                              | + .150                                 | S. W.      | 18                                                                  | 10                             | 3.22                                                | Strong wind.      |
| Madras .....    | .795                                              | + .020                                 | W.         | 6                                                                   | 7                              | 1.83                                                | Thunder<br>storm. |
| Bangalore ..... | .794                                              | — .009                                 | W. S. W.   | 10                                                                  | 6                              | ...                                                 | Fine.             |

The observations taken throughout India shew that the barometric depression had continued to travel westward in the same general direction as during the previous two days, and with the same velocity approximately as during the afternoon of the 1st. A rapid recovery of pressure had occurred over the greater part of the Central Provinces, amounting at several stations to '15'. The barometer had on the other hand fallen over the districts towards which the centre was advancing. The fall was greatest at Indore, where it slightly exceeded '25" since 10 A. M. of the 1st. Pressure had decreased over the whole of the Punjab, the North-Western Provinces, Bombay, and the greater part of Bengal and Burmah. This fall was due to general actions unconnected with the continuance of the depression in Western India.

The general character of the air motion remained the same, except in the neighbourhood of the moving area of depression. Southerly winds now prevailed in the Central Provinces. The westerly winds on the Bombay coast were slightly stronger than they had been on the previous day. The easterly winds prevalent over the area to the north and north-east of the storm centre were comparatively dry, and little or no rain fell in that part of the depression where they were blowing. The rainfall was heavy in the southern quadrant of the disturbance.

Little or no rain was falling at the time in Assam, North Bengal, Behar, the North-Western Provinces, the Punjab, and over the greater part of Bombay.

During the interval between 4 P. M. of the 1st and 10 A. M. of the 2nd, the centre continued to advance in a general westerly direction through the Narbadda Division of the Central Provinces.

The following are the observations taken at the meteorological stations in the area of depression at 10 A. M. of the 2nd.

| STATIONS.      | Barometer at 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Wind.                 |                                                       | Cloud amount at 10 A. M. | Rainfall at 10 A. M. preceding 24 hours. | Weather          |
|----------------|---------------------------------------------|-------------------------------------|-----------------------|-------------------------------------------------------|--------------------------|------------------------------------------|------------------|
|                |                                             |                                     | Direction at 10 A. M. | Amount in miles per hour since 10 A. M. previous day. |                          |                                          |                  |
| Saugor .....   | 29.488                                      | — .056                              | N. E.                 | 11.0                                                  | 8                        | 0.38                                     | Showery.         |
| Akola.....     | .577                                        | — .061                              | W.                    | 22.0                                                  | 10                       | 7.43                                     | Continuous rain. |
| Amraoti.....   | .553                                        | — .050                              | W. S. W.              | 42.0                                                  | 9                        | 6.35                                     | Ditto.           |
| Neemuch .....  | .509                                        | — .154                              | E. N. E.              | 20.0                                                  | 10                       | 0.86                                     | Showery.         |
| Indore .....   | .410                                        | — .259                              | N. E.                 | 13.0                                                  | 10                       | 1.58                                     | Showery.         |
| Jeypore .....  | .541                                        | — .137                              | E. S. E.              | 7.0                                                   | 6                        | ..                                       | Fine.            |
| Ajmere .....   | .546                                        | — .140                              | N. E.                 | 5.0                                                   | 4                        | 0.43                                     | Thunder.         |
| Khandwa .....  | .494                                        | — .141                              | W. S. W.              | 13.0                                                  | 10                       | 2.64                                     | Continuous rain. |
| Mount Abu ...  | 25.692                                      | — .169                              | N.                    | 9.0                                                   | 9                        | 3.34                                     | Ditto.           |
| Surat .....    | 29.588                                      | — .138                              | S. W.                 | 17.0                                                  | 10                       | 0.33                                     | Showery.         |
| Malagaon ..... | .670                                        | — .073                              | W.                    | 18.0                                                  | 10                       | 2.83                                     | Continuous rain. |
| Nagpore .....  | .621                                        | + .150                              | S. W.                 | 18.0                                                  | 10                       | 3.22                                     | Strong wind.     |
| Seoni .....    | .603                                        | + .140                              | S.                    | 12.0                                                  | 8                        | 1.20                                     | Continuous rain. |
| Jubbulpore ... | .599                                        | + .116                              | S.                    | 12.0                                                  | 9                        | 0.05                                     | Strong wind.     |



The barometer was lowest at Indore. The barometric heights and wind directions, when charted, indicate that the centre of the depression was at noon very near Indore and to the east of it, and hence in Lat.  $22\frac{1}{2}^{\circ}$  N. and Long.  $76^{\circ}$  E. Strong winds and very heavy rain characterized the western and southern quadrants. In the northern quadrant, winds were much more moderate, and rain fell only near the centre of the depression.

The following are the 4 P. M. observations, which enable the position of the depression and its centre to be determined at that hour:—

| STATION.        | Barometer at 4 P. M. reduced to sea level. | Change since 4 P. M. previous day. | Wind.                |                                         | Cloud amount at 4 P. M. | Weather.     |
|-----------------|--------------------------------------------|------------------------------------|----------------------|-----------------------------------------|-------------------------|--------------|
|                 |                                            |                                    | Direction at 4 P. M. | Amount in miles per hour since 10 A. M. |                         |              |
| Saugor .....    | 29.473                                     | + .061                             | S.                   | 14.0                                    | 8                       | Cloudy.      |
| Akola.....      | .529                                       | + .020                             | W. S. W.             | 21.7                                    | 10                      | Strong wind. |
| Amraoti.....    | .565                                       | + .136                             | S. W.                | 23.3                                    | 10                      | Strong wind. |
| Neemuch .....   | .368                                       | — .148                             | E.                   | 11.7                                    | 9                       |              |
| Indore .....    | .414                                       | — .119                             | S. W.                | 8.7                                     | 10                      | Overcast.    |
| Jeypore .....   | .398                                       | — .125                             | E.                   | 10.9                                    | 7                       | Strong wind. |
| Ajmere .....    | .399                                       | — .183                             | E.                   | 12.4                                    | 5                       |              |
| Khandwa .....   | .444                                       | — .034                             | W.                   | 17.6                                    | 10                      |              |
| Surat .....     | .495                                       | — .135                             | W. S. W.             | 33.0                                    | 10                      | Overcast.    |
| Malegaon .....  | .557                                       | — .050                             | W.                   | 19.8                                    | 10                      | Strong wind. |
| Deesa.....      | .370                                       | — .166                             | W.                   | 18.0                                    | 10                      | Overcast.    |
| Rajkot .....    | .458                                       | — .131                             | W.                   | 20.3                                    | 10                      | Strong wind. |
| Bhuj .....      | .422                                       | — .151                             | W.                   | 15.8                                    | 8                       | Strong wind. |
| Hyderabad ..... | .422                                       | — .175                             | S. W.                | 5.0                                     | 9                       | Overcast.    |

Allowing for the amount of the diurnal oscillation between 10 A. M. and 4 P. M., it will be seen that the barometer had fallen during the preceding six hours at Neemuch, Ajmere, and Deesa, whilst it had risen rapidly in the Central Provinces. The centre was between Neemuch and Deesa, where the barometric heights were practically the same, and winds were in opposite directions. It was approximately in Lat.  $23^{\circ} 30'$  N. and Long.  $74^{\circ} 30'$  E.

The following table gives the rainfall in each district of the Central Provinces during the 24 hours preceding 6 P. M. of the 2nd.

| Division.    | District.      | Average Rainfall of district. | Highest in district. |
|--------------|----------------|-------------------------------|----------------------|
| Chattisgarh  | Sambalpore     | 0.09                          | 0.45                 |
|              | Raipore.....   | nil.                          | nil.                 |
|              | Bilaspore ...  | 0.05                          | 0.20                 |
|              | Bhandara ...   | 0.25                          | 0.70                 |
| Nagpur ..... | Balaghat ...   | 0.71                          | 1.90                 |
|              | Nagpur ...     | 2.25                          | 3.86                 |
|              | Wardha ...     | nil.                          | nil.                 |
|              | Jubbulpore     | 0.02                          | 0.05                 |
| Jubbulpore   | Seoni.....     | 0.06                          | 0.17                 |
|              | Mandla.....    | nil.                          | nil.                 |
|              | Damoh .....    | 0.07                          | 0.20                 |
|              | Saugor... ..   | 0.10                          | 0.41                 |
| Narbudda     | Narsinghpore   | 0.19                          | 0.75                 |
|              | Chhindwara ... | 0.06                          | 0.19                 |
|              | Betul.....     | 0.91                          | 2.45                 |
|              | Hoshangabad    | 0.96                          | 3.35                 |
|              | Nimar .....    | 5.62                          | 8.20                 |

The rainfall of the previous 24 hours was small in amount. The Nagpur district received local heavy rainfall. The only district where the rainfall due to the cyclonic disturbance was large in amount was the Nimar district. It was in the southern quadrant of the storm area during the greater part of the day, and received an average of 5.62 inches.

3rd July.—The following table gives the observations for the 3rd July at the chief meteorological stations in India :—

| STATION.       | Barometer at 10 A.M. reduced to sea level. | Change since 10 A.M. previous day | Wind.    |    | miles per hour since 0 A.M. previous day. | Cloud at 10 A. | Rainfall of previous 24 hours. | Weather. |
|----------------|--------------------------------------------|-----------------------------------|----------|----|-------------------------------------------|----------------|--------------------------------|----------|
|                |                                            |                                   | 10 h.    |    |                                           |                |                                |          |
| Calcutta ..... | 29.685                                     | + .012                            | E. S. E. | 3  | 9                                         | nil.           | Fine.                          |          |
| Allahabad ...  | 712                                        | + .099                            | N.       | 4  | 4                                         | nil.           | Fine.                          |          |
| Lahore ... ..  | 613                                        | + .023                            | E.       | 1  | 5                                         | nil.           | Fine.                          |          |
| Kurrachee .... | 446                                        | + .110                            | N. N. W. | 18 | 9                                         | 0.05           | Gloomy.                        |          |
| Bombay.....    | 732                                        | + .024                            | S. S. W. | 25 | 10                                        | 0.21           | Gale of wind.                  |          |
| Joypore.       | 664                                        | + .123                            | S. S. W. | 12 | 8                                         | nil.           | Strong wind.                   |          |
| Nagpur .       | 760                                        | + .139                            | S. S. W. | 6  | 5                                         | 0.04           | Showery.                       |          |
| Madras ....    | 845                                        | + .050                            | S. W.    | 6  | 5                                         | 0.11           | Showery.                       |          |
| Bangalore      | 854                                        | + .060                            | S. W.    | 8  | 5                                         | nil.           | Fine.                          |          |

The depression was now in the immediate neighbourhood of the Arabian Sea, between Kurrachee and Rajkot. The barometer during the previous 24 hours had fallen between '1" and '15" in Sind, Gutch, Guzerat, and the adjacent districts of Rajputana. In the rear of the disturbance, over the Central Provinces, the Berars, and Central India, a recovery of pressure, varying in amount between '15" and '25", had occurred. Over the remainder of India, pressure had increased briskly. The depression in Gutch and Guzerat had consequently been emphasized by these changes, and the baric gradients over the area of depression were large. South-westerly gales were now blowing on the west coast, from Bombay northwards, and were giving very heavy rain over the southern and eastern portions of the depression. Over Northern India, the winds varied considerably in direction and were light and unsteady. The weather was cloudy, and light and partial rain was falling, over the greater part of Northern India, except the Punjab and parts of the North-Western Provinces.

The centre of the depression at 4 P. M. on the 2nd was to the west of Neemuch in the Indore State, and was advancing westwards into Guzerat. The following table gives the 10 A. M. observations of the 3rd at the stations in the area of cyclonic disturbance :—

| STATIONS.        | Barom.<br>at 10<br>A. M.<br>reduced to<br>sea level. | 10<br>se since<br>10<br>A. M.<br>previous | Wind.                    |                                                                     | Weather.                                 |
|------------------|------------------------------------------------------|-------------------------------------------|--------------------------|---------------------------------------------------------------------|------------------------------------------|
|                  |                                                      |                                           | Direction<br>at 10 A. M. | Amount in<br>miles per<br>hour since<br>10 A. M. pre-<br>vious day. |                                          |
| Kurrachee . . .  | 29·446                                               | --·110                                    | N. N. W.                 | 18·0                                                                | Gloomy.                                  |
| Rajkote . . . .  | 29·435                                               | —·171                                     | S. W.                    | 33·0                                                                | Dust storm<br>with rain.                 |
| Deesa . . . . .  | 29·467                                               | —·076                                     | S. E.                    | 17·0                                                                | Threatening<br>weather.                  |
| Ajmere . . . . . | 29·636                                               | +·090                                     | S. E.                    | 11·0                                                                | Strong wind.                             |
| Indore . . . . . | 29·676                                               | +·266                                     | S. E.                    | 7·0                                                                 | Gloomy.                                  |
| Neemuch . . . .  | 29·639                                               | +·130                                     | S. S. W.                 | 22·0                                                                | Thunder and<br>lightning at<br>distance. |
| Bhuj . . . . .   | 29·326                                               | —·207                                     | N. N. W.                 | 3·0.                                                                | Fine.                                    |
| Hyderabad . . .  | 29·420                                               | —·137                                     | N.                       | 5·0                                                                 | Strong wind.                             |

The barometer had risen rapidly at Indore and Neemuch, whilst it had fallen somewhat less rapidly at Bhuj, Rajkote, Deesa, Hyderabad, and Kurrachee. The preceding observations indicate that the centre

was between the three stations of Bhuj, Rajkote, and Deesa, and probably not far from the first-named station, in Lat.  $23\frac{1}{2}^{\circ}$  N. and Long.  $69\frac{3}{4}^{\circ}$  E., and hence nearly in the centre of the district of Cutch. The observations show that winds were unusually light in the north-western quadrant. The average wind velocity at Bhuj during the previous 24 hours was only 3 miles, and at Hyderabad 5 miles. The westerly and south-westerly winds at Rajkote and other stations in the easterly and southerly quadrants contrast strikingly with the feeble winds to the north of the centre of the depression.

The following are the 4 P. M. observations taken at the stations within the storm area:—

| STATIONS.      | Barometer at 4 P. M. reduced to sea level. | Change since 4 P. M. previous day. | Wind.                |                                         | Cloud amount at 4 P. M. | Weather.      |
|----------------|--------------------------------------------|------------------------------------|----------------------|-----------------------------------------|-------------------------|---------------|
|                |                                            |                                    | Direction at 4 P. M. | Amount in miles per hour since 10 A. M. |                         |               |
| Kurrachee..... | 29.304                                     | — .182                             | N. N. W.             | 16.8                                    | 10                      | Strong wind.  |
| Rajkote ....   | 29.454                                     | — .004                             | S. S. W.             | 32.3                                    | 10                      | Strong wind.  |
| Mount Abu ..   | 29.598                                     | + .042                             | S.                   | 13.8                                    | 10                      | Gloomy.       |
| Ajmere . . . . | 29.565                                     | + .166                             | W.                   | 12.2                                    | 5                       | Gloomy.       |
| Indore .....   | 29.627                                     | + .213                             | S.                   | 6.7                                     | 10                      | Gloomy.       |
| Neemuch ....   | 29.587                                     | + .219                             | S. S. W.             | 11.2                                    | 10                      | Gloomy.       |
| Bhuj .....     | 29.215                                     | — .207                             | S.                   | 25.7                                    | 10                      | Thunderstorm. |
| Hyderabad ...  | 29.317                                     | — .105                             | E. N. E.             | 58.8                                    | 6                       | Strong wind.  |
| Jacobabad..... | 29.382                                     | — .066                             | E.                   | 17.2                                    | 6                       | Strong wind.  |
| Multan .....   | 29.481                                     | + .021                             | N. E.                | 3.0                                     | 4                       | Fine.         |

When the observations are charted, they indicate that the centre was between Bhuj and Kurrachee, where the barometric readings were lowest, and winds were from S. and N. N. W.; and at a short distance to the W. N. W. of the former station. Its probable position was in Lat.  $23\frac{3}{4}^{\circ}$  N. and Long.  $68\frac{3}{4}^{\circ}$  E. If allowance be made for the diurnal oscillation, it will be seen that the barometer had altered little at Bhuj, and was rising quickly at Rajkote, but continued to fall rather rapidly at Kurrachee.

The following table gives the average rainfall in the divisions of Bengal:—

|                     | Average rainfall<br>in previous 24<br>hours. | Highest rainfall<br>in 24 hours. |
|---------------------|----------------------------------------------|----------------------------------|
| Orissa.....         | 0·03                                         | 0·30                             |
| South West Bengal   | 0·04                                         | 0·52                             |
| East Bengal .....   | 0·12                                         | 1·40                             |
| North Bengal .....  | 0·04                                         | 0·56                             |
| North Behar .....   | nil.                                         | nil.                             |
| South Behar .....   | 0·03                                         | 0·40                             |
| Chutia Nagpur ..... | 0·06                                         | 0·50                             |

The above return shews that, with the exception of a few local showers, rain had ceased in the Province of Bengal.

As daily returns of rainfall in Central India and the Bombay Presidency are not at my disposal, it is not possible to give full details of this element of observation for the previous 24 hours. The returns of Bhuj, Rajkote, Kurrachee, &c., however, indicate clearly that the rainfall was heavy over the southern half of the cyclonic area and light over the northern.

*4th July.*—The following are observations taken at 10 A. M. of the 4th, and illustrate the more important changes that had occurred during the previous 24 hours in the meteorology of India.

| STATIONS.     | Barometer at 10<br>A. M. reduced to<br>sea level | Change since 10<br>A. M. previous<br>day. | Wind.                 |                                                                         | Cloud amount at 10<br>A. M. | Rainfall at 10 A. M.<br>preceding 24 hours. | Weather.             |
|---------------|--------------------------------------------------|-------------------------------------------|-----------------------|-------------------------------------------------------------------------|-----------------------------|---------------------------------------------|----------------------|
|               |                                                  |                                           | Direction at<br>10 h. | Amount<br>in miles<br>per hour<br>since<br>10 A. M.<br>previous<br>day. |                             |                                             |                      |
| Calcutta .    | 29·643                                           | — 0·42                                    | N. W.                 | 5                                                                       | 10                          | 2·12                                        | Gloomy.              |
| Allahabad ... | 29·669                                           | — 0·43                                    | N. W.                 | 2                                                                       | 5                           | ...                                         | Fine.                |
| Lahore ....   | 29·652                                           | + 0·39                                    | Calm.                 | 5                                                                       | 6                           | 0·89                                        | Fine.                |
| Kurrachee...  | 29·380                                           | — 0·66                                    | E.                    | 33                                                                      | 10                          | 0·83                                        | Duststorm with rain. |
| Bombay.....   | 29·867                                           | + 1·35                                    | S.                    | 28                                                                      | 10                          | 0·23                                        | Gale of wind.        |
| Jeypore ..... | 29·751                                           | + 0·87                                    | W. N. W.              | 7                                                                       | 8                           | ...                                         | Fine.                |
| Nagpore.....  | 29·811                                           | + 0·51                                    | W.                    | 4                                                                       | 7                           | ...                                         | Fine.                |
| Madras .....  | 29·864                                           | + 0·19                                    | W. S. W.              | 7                                                                       | 4                           | ...                                         | Fine.                |
| Bangalore ... | 29·901                                           | + 0·47                                    | W.                    | 7                                                                       | 4                           | ...                                         | Fine.                |

The observations taken at the observing stations in Sind and Guzerat at 10 A. M. are given below. They shew that the whirl was still quite distinctly marked, that it continued to advance to the westward, and that it was now near the Head of the Arabian Sea, to the S. W. of Kurrachee. A rapid rise of the barometer had occurred over upper Sind and Guzerat. Kurrachee was the only station where pressure was lower than on the morning of the 3rd. South-westerly winds prevailed in Cutch and Guzerat. The wind had shifted round to east at Kurrachee, and was blowing with considerable force. It brought up a dust-storm from the Rajputana desert followed by rain.

The centre of the depression had crossed the Sind coast during the previous evening. It is not possible to follow its motion further, as no observations are available for this portion of its path. It is, however, probable that it speedily broke up.

The following 10 A. M. observations taken at stations in Western India nearest the area of cyclonic disturbance illustrate the previous remarks.

| STATION.      | Barometer 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Wind.                 |                                                       |                          | Rainfall at 10 A. M. preceding 24 hours. | Weather.                               |
|---------------|------------------------------------------|-------------------------------------|-----------------------|-------------------------------------------------------|--------------------------|------------------------------------------|----------------------------------------|
|               |                                          |                                     | Direction at 10 A. M. | Amount in miles per hour since 10 A. M. previous day. | Cloud amount at 10 A. M. |                                          |                                        |
| Kurrachee ..  | 29.380                                   | — .066                              | E.                    | 33.0                                                  | 10                       | 0.83                                     | Duststorm with rain.                   |
| Mount Abu     | 25.890                                   | + .221                              | S. S. W.              | 17.0                                                  | 10                       | 2.36                                     | Passing showers.                       |
| Deesa .....   | 29.725                                   | + .258                              | S.                    | ?                                                     | 10                       | 0.39                                     | Strong wind.                           |
| Rajkote ..... | 29.695                                   | + .260                              | S. S. W.              | 24.0                                                  | 10                       | 0.58                                     | Clouds low, moving rapidly with scuds. |
| Bhuj .....    | 29.583                                   | + .257                              | S. S. W.              | 11.0                                                  | 10                       | 4.24                                     | Continuous rain.                       |
| Hyderabad .   | 29.626                                   | + .206                              | S. W.                 | 24.0                                                  | 10                       | 0.05                                     | Gale of wind.                          |
| Jacobabad...  | 29.614                                   | + .132                              | E.                    | 90                                                    | 3                        | ...                                      | Fine weather with passing clouds.      |
| Mooltan.....  | 29.648                                   | + .073                              | S. W.                 | 30                                                    | 0                        | ...                                      | Fine weather with passing clouds.      |

The following 4 P. M. observations shew that the barometer was rising rapidly at Kurrachee, as well as at the neighbouring stations, and that the wind at that station was slowly shifting round to its normal direction (S. W.) in July. They indicate clearly the continued existence of the whirl at the head of the Arabian Sea.

| STATIONS.      | Barometer at 4 P. M.<br>reduced to sea level | Change<br>since 4 P.<br>M. of day | Wind.    |                                                  | Cloud am<br>4 P. M. | Weather.     |
|----------------|----------------------------------------------|-----------------------------------|----------|--------------------------------------------------|---------------------|--------------|
|                |                                              |                                   | Dir      | Amount in<br>miles per<br>hour since<br>10 A. M. |                     |              |
| Kurrachee..... | 29.490                                       | + .186                            | E. S. E. | 38.7                                             | 10                  | Strong wind. |
| Mount Abu ..   | 25.856                                       | + .258                            | S. S. W. | 18.5                                             | 10                  | Gloomy.      |
| Deesa .. . . . | 29.667                                       | + .163                            | E. N. E. |                                                  | 10                  | Strong wind. |
| Rajkote .. . . | 29.653                                       | + .199                            | S. W.    | 28.7                                             | 8                   | Strong wind. |
| Bhuj .. . . .  | 29.581                                       | + .366                            | S. S. W. | 23.0                                             | 10                  | Strong wind. |

The history of the cyclone ends with the evening of the 4th, as the observations of the 5th and subsequent days shew that normal winds were established in Sind, and no further evidence of the existence of the cyclonic whirl is furnished by the land observations.

### CHAPTER III.

#### DISCUSSION OF THE MORE IMPORTANT FEATURES OF THE STORM OF THE 26TH JUNE TO THE 4TH JULY, 1883.

The cyclonic storm of the last week of June and the first week of July is interesting in several respects. It occurred after the rains had fully set in over Bengal, and was of unusual intensity in the Bay for a storm of the rains. After it passed into the Central Provinces, it acquired fresh energy, and advanced slowly across the Head of the Peninsula into Guzerat. During this part of its motion, it gave excessive rain, and presented in a marked degree the phenomena of a south-west monsoon storm on land. It was thus one of the most complete storms of the rains that has occurred in recent years, and as such is deserving of careful study. Before discussing its more important features in detail, it appears desirable to give a brief connected history of the antecedents, the formation, the progress, and the dissolution of the storm.

The south-west monsoon proper of 1883 commenced a few days earlier than usual at the Head of the Bay and in Bengal. The Bombay branch of the monsoon current was first felt in force on the Bombay coast on the 24th and 25th of June, when strong winds, almost approaching to a gale, were blowing, and general rain began and extended to the Central Provinces. Very shortly after the commencement of the south-west

monsoon proper in Bengal, an atmospheric eddy, or cyclonic vortex, formed in the north-west angle of the Bay. It passed through North Orissa, Chutia Nagpore, and South Behar into North Behar, where it broke up on the 20th of June. This disturbance drew large supplies of vapour from the southerly current advancing into Bengal from the Bay, which it discharged as rain in unusually large amounts over a considerable portion of Central and North Behar, and thus occasioned very heavy floods in the Gya, Behar, Patna, Durbhanga, and Mozufferpore districts.

The disappearance of this eddy or whirl was followed by a partial break in the rains. The winds, although they continued to blow from the normal directions over Bengal and in the south and centre of the Bay, fell off in strength. The sky was less densely clouded, more especially in Central Bengal and Behar. The air also was drier, and the rainfall much smaller in amount and confined to local showers, which fell chiefly in the neighbourhood of the hills in North and East Bengal. Whilst this partial break in the rains (which commenced on the 20th) held in Bengal, the winds diminished in strength *pari passu* over the north of the Bay. They were light to moderate, and rarely exceeded force 3. The weather was comparatively fine, and the sea almost smooth.

The wind observations taken at Nancowry and Port Blair show that the south-westerly winds of the centre and south of the Bay, which had been very feeble from the 15th, began to increase in force on the 23rd, and blew strongly during the remainder of the month. This apparently indicated the commencement of another burst of the monsoon.

It appears to be a general rule that each strong advance of south-west monsoon winds and consequent influx of aqueous vapour into Bengal commences in the south of the Bay. The winds first strengthen, for some days in that part of the Bay, as is proved by the wind observations at the Ceylon stations and at Nancowry in the Nicobars. The area of strong winds then extends northwards. When the advancing strong winds approach the Burmah and Bengal coasts, there is a strong tendency to eddying motion at and near the front. This incipient vorticose motion may, under favourable conditions, develop into a large cyclonic circulation and storm.

The strong current, in the present instance, advanced northwards along the Burmese and Arrakan coasts, and increased the strength of the winds at Diamond Island from the 25th, and at Akyab from the 26th. These may, therefore, be assumed as the dates of the arrival of the front of the advancing mass of air in the latitudes of these two stations. The log of the Pemba proves that, on the 27th, the force of the winds off the west Burmese coast was very considerable and averaged 9. At the same time that these strong winds were blowing off the Burmese coast, the winds at the Head of the Bay



were very light and variable, and of average force not exceeding 2. The strong advancing south-westerly current was opposed by the line of the Arrakan hills, by the resistances due to friction between itself and the earth's surface, and by the slower moving air currents to the west. The actual effect of the various resistances was to produce a deflection of the current to the west in the neighbourhood of the Burmese and Arrakan coasts, and a large amount of eddying or rotatory motion in the front of the current, and, therefore, also of ascensional motion and its concomitant action (in the case of a very humid current), rainfall. The energy or latent heat given out in the process of condensation, or rain formation, in its turn increased the ascensional motion, and the various actions and reactions gave rise to an extensive whirl near the Head of the Bay. The existence of this was plainly indicated on the morning of the 27th, when winds shifted round to north-east over the north-west of the Bay. Very heavy rain ("torrents of rain") were then falling over a comparatively small area near the Head of the Bay, which became an area of increasing barometric depression and of cyclonic air motion. The disturbance increased in intensity on the 28th and moved slowly westwards near the parallel of  $21^{\circ}$  N. At 10 A. M. of the 29th, the centre of the depression was between the Light Vessels at the Intermediate and Upper Gaspar stations. It was then travelling with an average velocity of about 3 miles an hour. Its rate of motion apparently increased as it approached the Balasore coast.

The storm advanced in a general W. N. W. direction during the afternoon of the 29th, and crossed the Balasore coast a few miles to the north of the station of Balasore a little before midnight. It then apparently marched without change of direction across the North Orissa hills, as, next morning at 10 A. M., the centre of the barometric depression was near to Sambalpore and in the continuation of its line of its advance on the 29th. The disturbance apparently diminished for some time, but began to draw supplies of vapor from the Bombay branch of the monsoon current, which had been blowing strongly for some days previous. In consequence of the increased energy thus given to it, it again intensified slightly and moved almost due westward across the Head of the Peninsula at an average rate of about fifteen miles per hour. On the morning of the 1st, the centre was near Seoni, on the morning of the 2nd near Indore, and on the morning of the 3rd near Bhuj, whence it passed westwards across the coast into the Arabian Sea, and was a little to the south of Kurrachee on the evening of the 3rd. The wind directions at Kurrachee and the neighbouring stations indicated cyclonic indraught to a centre, to the south-west of Kurrachee on the morning of the 4th, after which they give no further indications of

its existence. In the absence of observations, it is impossible to state whether it broke up immediately, or passed over the whole breadth of the Arabian Sea.

The following table gives the positions of the centre at the hours stated, from the 27th of June to the date of its disappearance beyond the limits of India in the Arabian Sea:—

| Date.            | Hour.    | Position of centre. |                  | Distance travelled during preceding interval. | Rate of motion. |
|------------------|----------|---------------------|------------------|-----------------------------------------------|-----------------|
|                  |          | Latitude.<br>N.     | Longitude.<br>E. |                                               |                 |
| June 27th ... {  | Noon.    | 20° 30'             | 89° 45'          | 12                                            | 3               |
|                  | 4 P. M.  | 20° 35'             | 89° 35'          |                                               |                 |
| June 28th ... {  | 10 A. M. | 21° 0'              | 88° 45'          | 62                                            | 3½              |
|                  | Noon.    | 21° 3'              | 88° 40'          | 6½                                            | 3¼              |
|                  | 4 P. M.  | 21° 10'             | 88° 30'          | 13                                            | 3¼              |
| June 29th ... {  | 10 A. M. | 21° 30'             | 87° 55'          | 45                                            | 2½              |
|                  | Noon.    | 21° 30'             | 87° 50'          | 5½                                            | 2¼              |
|                  | 4 P. M.  | 21° 35'             | 87° 30'          | 22                                            | 5½              |
| June 30th ... {  | 10 A. M. | 22° 0'              | 84° 0'           | 230                                           | 13              |
|                  | 4 P. M.  | 22° 0'              | 83° 30'          | 32                                            | 5½              |
| July 1st ..... { | 10 A. M. | 22° 0'              | 81° 0'           | 162                                           | 9               |
|                  | 4 P. M.  | 22° 0'              | 79° 45'          | 80                                            | 13½             |
| July 2nd ..... { | 10 A. M. | 22° 30'             | 76° 0'           | 245                                           | 13½             |
|                  | 4 P. M.  | 23° 30'             | 74° 30'          | 120                                           | 20              |
| July 3rd ..... { | 10 A. M. | 23° 30'             | 69° 45'          | 308                                           | 17              |
|                  | 4 P. M.  | 23° 45'             | 68° 45'          | 66                                            | 11              |

The atmospheric whirl was fully developed on the 27th and continued intact for at least seven days. During the latter part of its existence, it drifted across from the coast of Orissa to the coast of Cutch, or Sind, and disappeared and probably broke up in the Arabian Sea.

The following table gives the lowest reading of the barometer at 10 A. M., the average barometric height at the same station, and the amount of the greatest known barometric depression at 10 A. M. on each day:—

|                              | Lowest<br>10 A. M.<br>barometric<br>reading. | Average<br>10 A. M.<br>barometric<br>height.<br>July 1st. | Depression, |
|------------------------------|----------------------------------------------|-----------------------------------------------------------|-------------|
| June 29th.. Bay (Sundheads)  | 29·140                                       | 29·602                                                    | ·462        |
| June 30th.. Sambalpore ..... | 29·353                                       | 29·589                                                    | ·236        |
| July 1st ... Seoni.....      | 29·463                                       | 29·624                                                    | ·161        |
| July 2nd... Indore .....     | 29·410                                       | 29·662                                                    | ·252        |
| July 3rd ... Bhuj .....      | 29·326                                       | 29·616                                                    | ·290        |
| July 4th ... Kurrachee ..... | 29·380                                       | 29·589                                                    | ·209        |

Hence the barometric depression at the Head of the Bay was very nearly half an inch. During its progress overland, the depression observed nowhere exceeded '29", and, as two of the stations named in the preceding table (Indore and Bhuj) were at a very short distance from the centre, it is almost certain that the barometric depression on land, after crossing the Orissa hills, never exceeded three-tenths of an inch. The decrease in the amount of the depression was evidently due to the greater frictional resistance encountered by the cyclonic disturbance on land than at sea.

An interesting feature of the storm was that its centre moved in a path which was approximately straight. The general direction of its path was N. 83° W. or almost due west.

The steady march in an almost constant direction across the Continent is very striking, when the varying character of the surface over which it passed is taken into consideration. During the first part of its existence, it passed slowly over the water surface at the Head of the Bay, where the resistance to its motion was a minimum. After crossing the Balasore coast, it advanced intact over the North Orissa hills, a very broken and irregular country, the highest points of which are from 3000 to 4000 ft. high. It then crossed the highlands of Sambalpore (where the hills which rise out from the plateau attain an elevation varying from 1,500 to 2,500 feet) and passed over the comparatively low plain of Chhattisgarh, the average height of which is less than 1000 feet. Thence it advanced through the Balaghat, Seoni, Chhindwara, and Betul districts of the Central Provinces, which cover the extensive highlands known as

the Satpura plateau, and have an average height of 2000 feet. It thence passed across the valleys of the Taptee and Nerbudda and the Vindhya Hills into Indore and Malwa. The average elevation of the Vindhya Hills in that portion over which the cyclonic storm advanced is 2,500 feet. From Malwa, it passed westwards over the low plains of Guzerat and Cutch, the highest points of which do not exceed 800 or 900 feet in height, and crossed the coast of Sind between Bhuj and Kurrachee into the Arabian Sea, where its existence for at least twelve to eighteen hours afterwards is proved by the direction of the winds at Kurrachee and the neighbouring stations.

The above briefly indicates the varied character of the surface over which it advanced. During a considerable portion of its course on land, the average elevation of the country over which it travelled exceeded 2000 feet. Much of the ground was very broken and irregular country, the higher points of which exceeded 3000 feet in elevation. The only inference that can reasonably be drawn is that the cyclonic circulation extended to a height very considerably greater than 2000 or 3000 feet. Hence it was a cyclone of high elevation, and the cyclonic circulation near the earth's surface was of comparatively little importance, and not necessarily an index or measure of the intensity of the cyclone.

The chief features of the motion of the storm centre have already been indicated in the history of the cyclone. Its very slow motion during and for some time after its formation, or from noon of the 27th to noon of the 29th, is remarkable. During this interval of 48 hours, its rate of motion apparently never exceeded 5 miles per hour, and during the greater part of the period it varied between 2 and 4 miles. After noon of the 29th, it rapidly increased its speed, and, during the greater part of the next 24 hours, moved with a velocity varying between 10 and 15 miles. When the centre approached the high hills and broken ground of North Orissa, it experienced a very considerable retardation. As already stated (*vide* page 99), it lost energy and shewed signs of disintegration. The rainfall decreased in amount, the barometric depression was much smaller, and the disturbance was diffused over a larger area, although it was less regular and weaker in character. This was, however, followed by an increase of its energy due to its drawing supplies of vapour from the Bombay coast. The preceding changes were reversed. During this interval, the average rate of its motion was about 8 miles per hour. Its velocity increased on the 1st of July, and, during the remaining three days of its existence on land, it moved with a fairly uniform velocity of about 15 miles per hour.

Another important feature was the amount and distribution of the rainfall during the cyclonic storm. At the Head of the Bay, the rainfall

was torrential in character, more especially in the eastern and southern quadrants. The British Princess had "torrents of rain," the Saint Magnus "heavy continuous rain," the Star of Albion "thick continued rain," the Commillah "very heavy rain," and the Scottish Chieftain "heavy rain."

The following table gives the daily rainfalls during the period—June 28th to July 4th—at the meteorological stations situated in the area covered by the cyclonic storm during its existence on land :—

| Stations.        | June 1883. |       |       | July 1883. |      |       |      |
|------------------|------------|-------|-------|------------|------|-------|------|
|                  | 28th.      | 29th. | 30th. | 1st.       | 2nd. | 3rd.  | 4th. |
| Pooree .....     | 0·59       | 9·44  | 2·25  |            |      |       | 0·23 |
| Saagor Island.   | ...        | 0·17  | 0·36  |            |      | 1·08  | 3·82 |
| Balasore .....   | 0·94       | 2·65  | 5·64  | 0·17       | 0·21 | 0·12  | 0·76 |
| False Point .... | 8·04       | 5·39  | 1·10  | 0·05       |      |       | 0·09 |
| Cuttack .....    | 1·79       | 5·61  | 3·21  | ...        |      |       | ...  |
| Sambalpore ....  | 0·05       | 2·47  | 7·00  | 1·84       |      |       | 0·80 |
| Raipore .....    |            | 0·11  | 2·03  | 2·16       |      | 0·03  |      |
| Nagpur .....     | 0·17       | ...   |       | 6·22       | 1·12 |       |      |
| Seoni .....      | 1·22       | 0·45  |       | 5·65       | 0·17 |       |      |
| Jubbulpore ...   | 0·12       | 0·12  | 0·65  | 1·62       | 0·05 | 0·06  |      |
| Pachmarhi        | 1·29       |       | 0·02  | 5·99       | 1·36 |       | 0·05 |
| Amraoti .....    | 0·85       |       |       | 4·60       | 3·65 |       |      |
| Akola .....      | 0·42       |       |       | 2·17       | 6·85 | 0·03  |      |
| Indore .....     | 0·07       |       |       | 1·01       | 0·89 | 0·02  |      |
| Neemuch .....    | 0·04       |       | 1·47  | 0·86       | 0·21 | 0·09  |      |
| Surat .....      | 3·64       | 3·51  | 0·52  | 0·11       | 1·78 | 3·76  | 0·35 |
| Ahmedabad...     | 0·18       | 0·05  |       | ...        | 0·76 | 3·88  | 0·79 |
| Rajkote .....    |            | 0·46  |       | 0·13       | ...  | 10·05 | 0·40 |
| Bhuj .....       | 0·90       | 0·54  | 0·02  |            | 0·48 | 3·78  | 1·56 |
| Hyderabad ...    | 0·42       | ...   |       |            | ...  | 0·26  | 0·12 |
| Kurrachee ...    |            | 0·37  |       | 0·17       | 0·06 | 0·12  | 1·65 |
| Deesa .....      | 1·23       | 0·08  | 0·03  |            | 1·84 | 0·03  | 0·74 |
| Mount Abu ..     | 0·45       | 0·18  | 0·14  | 2·16       | 2·64 | 1·31  | 2·22 |
| Ajmere .....     | 0·07       |       |       |            | 0·43 | 0·10  |      |

As the rainfall was especially heavy in Orissa and the Central Provinces, I give the following table shewing the average district rainfall for each day of the period (June 27th to July 3rd) in these two divisions of the Empire, and illustrating more fully than the previous statement the distribution of the rainfall in a portion of the area covered by the disturbance. As daily returns of rainfall in Central India and the Bombay Presidency are not at my disposal, I am not able to give the corresponding data for the western portion of the course of the cyclone.

| Division.       | District.       | No. of<br>Station | 27   | 28   | 29   | 30   | 31   | 3rd. | Total      |
|-----------------|-----------------|-------------------|------|------|------|------|------|------|------------|
| Orissa .        | Pooree .....    | 5                 | 0.23 | 2.58 | 6.15 | 1.83 | 0.01 | nil. | 0.06 10.86 |
|                 | Cuttack .....   | 5                 | 1.06 | 3.03 | 4.50 | 2.07 | nil. | nil. | 9.66       |
|                 | Balasore .....  | 6                 | 0.71 | 2.00 | 2.66 | 3.02 | 0.09 | 0.09 | 0.13 8.70  |
|                 | Sambalpore .    | 5                 | 0.32 | 0.31 | 0.74 | 1.17 | 1.05 | 0.09 | 0.01 3.69  |
| Chittasgarh ... | Raipore .....   | 4                 | 1.74 | nil  | 0.73 | 1.30 | 1.60 | nil. | 0.01 5.38  |
|                 | Bilaspore ..... | 7                 | 0.11 | 0.51 | 0.35 | 0.51 | 0.56 | 0.05 | 0.01 2.05  |
|                 | Nagpur .....    | 5                 | 1.06 | 1.48 | 0.19 | nil. | 3.88 | 2.25 | 0.01 8.87  |
| Nagpore .       | Bhandara ....   | 3                 | 2.81 | 0.57 | 0.04 | 2.71 | 2.99 | 0.25 | 0.05 9.42  |
|                 | Wardha .....    | 4                 | 1.29 | 0.01 | nil. | 1.82 | 1.91 | nil. | 0.01 5.04  |
|                 | Balaghat .....  | 4                 | 1.21 | 0.08 | 0.23 | 0.03 | 2.47 | 0.71 | 0.06 4.79  |
|                 | Jubbulpore .... | 3                 | 0.59 | 0.13 | 1.44 | 0.54 | 0.66 | 0.02 | 0.02 3.40  |
| Jubbulpore..... | Saugor .....    | 4                 | 0.46 | 0.26 | nil. | 0.03 | 0.28 | 0.10 | nil. 1.13  |
|                 | Damoh .....     | 5                 | 0.41 | 0.04 | nil. | 0.26 | 0.27 | 0.07 | nil. 1.05  |
|                 | Seoni .....     | 3                 | 0.83 | 0.68 | 0.38 | 0.73 | 2.76 | 0.06 | 0.03 5.47  |
|                 | Mandla .....    | 7                 | 0.02 | 0.20 | 0.04 | 0.26 | 0.02 | nil. | nil. 0.54  |
|                 | Betul .....     | 7                 | 0.55 | 0.19 | 0.12 | 0.43 | 3.91 | 0.91 | 0.04 6.15  |
|                 | Chhindwara....  | 3                 | 1.15 | 0.37 | nil. | 1.03 | 4.16 | 0.06 | nil. 6.77  |
|                 | Hoshangabad .   | 5                 | 1.01 | 0.72 | 0.01 | 0.01 | 2.90 | 0.96 | 0.07 5.68  |
|                 | Nursinghpore .  | 4                 | 0.05 | 0.68 | 0.15 | 0.88 | 0.53 | 0.19 | nil. 2.48  |
| Nerbudda .....  | Nimar .....     | 3                 | 0.06 | 0.44 | 0.14 | nil. | 0.64 | 5.62 | 0.38 7.28  |

The chief peculiarity in the distribution of the rainfall was the contrast between the large amounts registered at stations to the south of the

line of advance and those received at stations situated to the north of the path of the centre.

The following tables give the average district rainfall in the districts immediately to the south of the centre and those to the north of it for the same periods in the Central Provinces, Orissa, and the adjacent districts of South-west Bengal :—

| Districts to north of<br>centre. | Total average<br>rainfall<br>June 27th to<br>July 1st. | Districts in Orissa to<br>south of centre. | Total average<br>rainfall<br>of the same<br>period. |
|----------------------------------|--------------------------------------------------------|--------------------------------------------|-----------------------------------------------------|
| 24-Pergunnahs .....              | 2.50                                                   | Balasore                                   | 8.47                                                |
| Midnapore .....                  | 3.58                                                   | Cuttack                                    | 9.66                                                |
|                                  |                                                        | Pooree                                     | 10.80                                               |

| Districts in the Cen-<br>tral Provinces to north<br>of the path of the<br>centre. | Total district<br>rainfall<br>June 30th to<br>July 2nd. | Districts of the Central<br>Provinces through<br>which the centre<br>passed, or which lay<br>to the south of the<br>path of the centre. | Total district<br>rainfall<br>June 30th to<br>July 2nd. |
|-----------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Bilaspore.....                                                                    | 1.12                                                    | Sambalpoce                                                                                                                              |                                                         |
| Mandla.....                                                                       | 0.28                                                    | Raipore .....                                                                                                                           |                                                         |
| Jubbulpore ..                                                                     | 1.22                                                    | Balaghat.....                                                                                                                           |                                                         |
| Narsinghpore                                                                      | 1.80                                                    | Seoni .....                                                                                                                             |                                                         |
| Damoh.....                                                                        | 0.60                                                    | Chindwara....                                                                                                                           |                                                         |
| Saugor.....                                                                       | 0.41                                                    | Hoshangabad.                                                                                                                            |                                                         |
|                                                                                   |                                                         | Nagpur .....                                                                                                                            |                                                         |
|                                                                                   |                                                         | Bhandara ....                                                                                                                           |                                                         |
|                                                                                   |                                                         | Wardha .....                                                                                                                            |                                                         |
|                                                                                   |                                                         | Betul .....                                                                                                                             |                                                         |
|                                                                                   |                                                         | Nimar.....                                                                                                                              |                                                         |

The centre, it should be remembered, passed westwards near the northern boundaries of Sambalpoce and Raipore and thence across the centre of the Balaghat, Seoni, Chindwara, and Hoshangabad districts. It will thus be seen that the rainfall was distinctly heaviest at some distance to the south of the path of the centre, and that the rainfall in the northern half of the cyclonic area was barely twenty-five per cent. of the amount received in the southern half.

It is not possible to give similar details for Central India and the northern districts of the Bombay Presidency. The following table gives the rainfall at the nearest meteorological observatories to the north and south of the path of the centre, and a glance will show that there was the same marked contrast between the rainfall in the northern and southern portions of the storm area during the latter part of its course, when it was approaching the Arabian Sea.

| Meteorological stations north of path of centre. | Total rainfall July 1st to 4th. | Meteorological stations south of path of centre. | Total rainfall July 1st to 4th. |
|--------------------------------------------------|---------------------------------|--------------------------------------------------|---------------------------------|
| Indore .....                                     | 1.92                            | Surat .....                                      | 5.80                            |
| Neemuch ...                                      | 1.16                            | Ahmedabad                                        | 5.43                            |
| Deesa .....                                      | 2.61                            | Malgaon ...                                      | 4.17                            |
| Ajmere.....                                      | 0.53                            | Bombay .....                                     | 1.09                            |
| Hyderabad                                        | 0.38                            | Rajkot .....                                     | 10.58                           |
| Kurrachee                                        | 2.00                            | Bhuj .....                                       | 5.82                            |

The previous peculiarities to a certain extent explain the striking contrast between the force of the wind in different quadrants, more especially when the storm was advancing over the sea or low ground. This has already been briefly referred to in the account of the meteorology of the present storm on the 28th and 29th (*vide* pages 86 and 93). It was there shown that the Pemba, at a distance of at least 200 miles to the south-east of the centre, had strong south-westerly winds of average force 9, which were frequently interrupted by excessively violent squalls; and that the ships and light-vessels, so long as they were in the western and northern quadrants, had winds from directions between N. W. and N. E. varying in force from 1 to 5, but that, when they passed in to the opposite quadrants, they experienced very violent westerly or south-westerly winds of force varying from 9 to 11.

This feature is shewn most strikingly by the anemometric observations taken at Saugor Island during the storm, which have been referred to in page 95, but are now given in full in illustration of this feature;—



| Date.       | Hour. | Barometer. | Wind.      |                                  | Weather and Sea.                                |
|-------------|-------|------------|------------|----------------------------------|-------------------------------------------------|
|             |       |            | Direction. | Amount during preceding 2 hours. |                                                 |
| June 28th.. | 13    | 29.332     | N. N. E.   | 37                               | Sea rough. Threatening.<br>Dark gloomy weather. |
|             | 15    | 389        | N. E.      | 38                               |                                                 |
|             | 17    | 287        | N. N. E.   | 45                               | Thunder and lightning at distance.              |
|             | 19    | 289        | N. N. E.   | 48                               |                                                 |
| June 29th.. | 21    | 327        | N.         | 43                               | Raining.                                        |
|             | 23    | 286        | N. W.      | 54                               | Strong wind.                                    |
|             | 1     | 204        | W.         | 53                               | Raining.                                        |
|             | 3     | 126        | N. N. E.   | 27                               | Sea very rough.                                 |
|             | 5     | 176        | N.         | 37                               |                                                 |
|             | 7     | 183        | N.         | 44                               |                                                 |
|             | 9     | 171        | E.         | 18                               |                                                 |
|             | 11    | 166        | E.         | 34                               | Dark gloomy weather.                            |
|             | 13    | 126        | N. N. E.   | 54                               |                                                 |
|             | 15    | 129        | W.         | 5                                |                                                 |
|             | 17    | 162        | S.         | 78                               |                                                 |
|             | 19    | 242        | S.         | 46                               | Sea tremendous.                                 |
|             |       |            |            |                                  | Severe gale of wind.                            |

Hence a prominent feature of this, as of many of the storms of the rains in the Bay, was excessively violent westerly and south-westerly winds in the southern and eastern quadrants and comparatively feeble winds in the northern and western quadrants. The great inequality of the winds in different quadrants in the majority of storms of the rains has caused them to be considered as mere westerly gales by seamen. It is, however, now proved beyond doubt that they are cyclonic disturbances in which the winds are rarely violent and dangerous except in the south and east quadrants, where westerly and south-westerly winds of force 8 to 10 may be experienced, interrupted by squalls as violent in character, so far as can be judged from the accounts of sailors, as are felt in the largest and most intense cyclones of the Bay.

The following additional illustrations are given of the difference of the force of the wind in the different quadrants of the cyclonic disturbance. It should, however, be remembered that it is difficult to explain many of

the differences in the amount of wind recorded at different stations apparently similarly situated with regard to the storm. They can only be ascribed either to erroneous reading of the anemometers by the observers at the stations under consideration, or to slight but influential differences in the geographical or topographical features of the districts or stations in which the meteorological observatories are situated. The latter appears to be the more probable explanation. •

|       | Stations.         | Direction. | Average wind velocity during previous 24 hours | Stations.         | Direction. | Average wind velocity during previous 24 hours. |
|-------|-------------------|------------|------------------------------------------------|-------------------|------------|-------------------------------------------------|
|       | Saugor Island ... | N. N. E.   | 8'0                                            | False Point ..... | W. S. W.   | 10'0                                            |
|       | Saugor Island ..  | E.         | 16'0                                           | False Point ..... | W. S. W.   | 23'0                                            |
| 30th. | Seoni .....       | N. W.      | 5'0                                            | Raipur .....      | W.         | 20'8                                            |
|       | Jubbulpore ..     | W. N. W.   | 6'0                                            | Cuttack .....     | W.         | 10'0                                            |
|       | Nagpur .....      | N. W.      | 9'0                                            | Saugor Island ... | S. E.      | 19'0                                            |
|       |                   |            |                                                | Balasore .....    |            |                                                 |
|       | Seoni .....       | N. N. W.   | 15'0                                           | Raipur .....      | S. W.      | 20'0                                            |
|       | Jubbulpore .....  | N. N. E.   | 8'0                                            | Nagpur .....      | W.         | 11'0                                            |
| 2nd   | Sutna .....       | E.         | 21'0                                           | Sambalpure .....  | S. W.      | 1'4                                             |
|       |                   |            |                                                | Cuttack .....     | W.         | 7'0                                             |
|       | Indore .....      | N. E.      | 13'0                                           | Surat .....       | S. W.      | 17'0                                            |
|       | Jeyporo .....     | N. E.      | 7'0                                            | Akola .....       | W.         | 22'0                                            |
|       | Ajmere .....      | E. N. E.   | 5'0                                            | Amraoti .....     | W. S. W.   | 43'0                                            |
|       | Saugor .....      | N. E.      | 11'0                                           | Khandwa .....     | W. S. W.   | 13'0                                            |
| 3rd   |                   |            |                                                | Nagpur .....      | S. W.      | 18'0                                            |
|       | Kurrachoo .....   | N. N. W.   | 18'0                                           | Raipur .....      | S. W.      | 33'0                                            |
|       | Bhuj .....        | N. N. W.   | 3'0                                            | Neemuch .....     | S. S. W.   | 22'0                                            |
|       | Hyderabad .....   | N.         | 8'0                                            | Deesa .....       | S. E.      | 17'0                                            |

The contrast between the winds in different quarters is also evidenced by the amounts of wind received at the same station from different directions. Thus, at Saugor Island, the amount of wind registered for the 24 hours preceding 4 p. m. of the 28th was 192 miles, and for the same period prior to 4 p. m. of the 29th it was 524 miles. The wind during these intervals was from N. E. During the next 24 hours, when southerly winds chiefly prevailed, 776 miles were recorded. Similarly, at Balasore, 240 miles were registered for the 48 hours pre-

ceding 10 A. M. of the 29th, and 576 miles during the succeeding 48 hours (with southerly winds). At Rajkot, the amount of north-westerly winds during the 24 hours preceding 4 P. M. of the 2nd was 272 miles, and at Bhuj 390 miles. During the next 24 hours, when south-westerly winds blew at these stations, 391 and 760 miles respectively were registered. The amount of wind (mainly from N. W.) recorded at Kurachee for the 24 hours preceding 4 P. M. on the 3rd was 406 miles. For the succeeding 24 hours, when easterly winds prevailed, 933 miles were registered.

There are other and less important features, to which it will be sufficient to refer briefly. One of these was the comparative smallness of the storm area proper. If we estimate it by the area in which strong winds prevailed and heavy rain fell, it almost certainly did not exceed 250 miles in length by 100 to 150 miles in breadth, at any time during its passage across the continent. The smallness of the storm area and the slight barometric depression in all storms of the rains are cognate features due probably to the peculiar conditions of their formation, as cyclones of high elevation. Another feature was the very great irregularity of the winds. This was shown (at Saugor Island, for instance) by intervals of comparatively feeble winds during the middle of the storm, and also by the apparent occurrence of much feebler winds at stations nearer to the centre than at those at a greater distance. As, however, anemometric observations are confessedly not intercomparable, it is not possible to establish the fact of this irregularity on such evidence.

## APPENDIX I.

*Extract from the Log of the F. L. V. Comet, giving observations during Storm of June 27th to 30th.*

| Date.              | Hour. | Wind.      |        | Barometer reduced. | Weather. | REMARKS.                                                                                                                                                                                                                                 |
|--------------------|-------|------------|--------|--------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |       | Direction. | Force. |                    |          |                                                                                                                                                                                                                                          |
| 28th of June 1882. | 8     | N.         | 4      | 29.321             | Thunder. | Commences with dirty threatening weather. Lightning all round the horizon. A long heavy swell from E. S. E. 3 A. M. Squally with passing showers, ugly appearance of weather.<br>8 A. M. Weather the same. A large circle round the sun. |

| Date.              | Hr. | Wind.      |        | Barometer reduced. | Weather. | REMARKS.                                                                                                                                      |
|--------------------|-----|------------|--------|--------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|
|                    |     | Direction. | Force. |                    |          |                                                                                                                                               |
| 28th of June 1883. | 9   | N. N. E.   | 4      | 29.327             |          |                                                                                                                                               |
|                    | 10  | N. E.      | 4      | 29.327             | Raining. |                                                                                                                                               |
|                    | 11  | ...        | 3to5   | 29.308             |          |                                                                                                                                               |
|                    | 12  | ...        | 4to6   | 29.277             | Thunder. | Noon. Every appearance of a cyclone. Heavy confused sea, with squally weather, and passing showers and thunder.                               |
|                    | 13  |            |        | 29.266             |          |                                                                                                                                               |
|                    | 14  | ...        | 6to5   | 29.252             | Thunder. |                                                                                                                                               |
|                    | 15  |            |        | 29.241             |          |                                                                                                                                               |
|                    | 16  | ...        | 5      | 29.215             | Squally. | 4 p. m. Wind and weather the same.                                                                                                            |
|                    | 17  |            |        | 29.220             |          | Observed the sky of dark red appearance to the southward and eastward.                                                                        |
|                    | 18  | N.         | 5      | 29.226             | Squally. |                                                                                                                                               |
|                    | 19  |            |        | 29.230             |          |                                                                                                                                               |
|                    | 20  | ...        | 5      | 29.253             | Thunder. | 8 p. m. Wind and weather the same.                                                                                                            |
|                    | 21  | ...        |        | 29.260             |          |                                                                                                                                               |
|                    | 22  | N. N. W.   | 5      | 29.236             | Thunder. |                                                                                                                                               |
|                    | 23  |            |        | 29.197             |          |                                                                                                                                               |
|                    | 24  | N. W.      | 6      | 29.195             | Thunder. | Midnight. Wind and weather the same. Barometer still falling, every appearance of heavy weather. Thunder and lightning all round the horizon. |
| 29th of June 1883. | 1   | W. N. W.   | 6      | 29.148             |          |                                                                                                                                               |
|                    | 2   | N. N. E.   | 6      | 29.070             | Raining. | Commences with dirty and very threatening weather. Lightning all round the horizon. A very heavy sea running from S. E. Winds variable.       |
|                    | 3   | ...        | 6      | 29.094             |          |                                                                                                                                               |
|                    | 4   | ...        | 5      | 29.074             | Thunder. |                                                                                                                                               |
|                    | 5   | N. N. W.   | 5to6   | 29.112             |          |                                                                                                                                               |
|                    | 6   | ...        | 6      | 29.126             | Squally. |                                                                                                                                               |
|                    | 7   | ...        | 6      | 29.138             |          |                                                                                                                                               |

| D. | Hour     | Wind.    |  | Baromete<br>reduced. | Weather.  | REMARKS.                                                                                                                                                              |
|----|----------|----------|--|----------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |          |          |  |                      |           |                                                                                                                                                                       |
|    |          | W.       |  | 29·120               | Squally.  | 8 A. M. Wind and weather the same, but sea increasing. Wind shifting all round the compass, from west through south and east, accompanied with terrific rain squalls. |
|    |          |          |  | 29·122               |           |                                                                                                                                                                       |
| 10 | S. S. E. | 3        |  | 29·140               | Squally.  |                                                                                                                                                                       |
| 11 |          |          |  | 29·086               |           |                                                                                                                                                                       |
| 12 | E. N. E. |          |  | 28·998               | Raining   | Noon. Blowing a furious gale with terrific heavy squalls. Sea still increasing and barometer falling.                                                                 |
| 13 | N. N. W  | 8        |  | 28·989               | Raining.  |                                                                                                                                                                       |
| 14 | W.       | 8        |  | 29·068               | Raining.  |                                                                                                                                                                       |
| 15 |          | 8        |  | 29·088               | Raining.  |                                                                                                                                                                       |
| 16 | S. W.    | 9        |  | 29·108               | Raining.  | 4 P. M. Wind and weather the same.                                                                                                                                    |
| 17 | S. S. W. |          |  | 29·184               | Raining.  |                                                                                                                                                                       |
| 18 | S. W.    |          |  | 29·184               | Raining.  |                                                                                                                                                                       |
| 19 | S. S. W. |          |  | 29·164               | Raining.  |                                                                                                                                                                       |
| 20 |          |          |  | 29·247               | Raining.  | 8 P. M. Wind and weather the same.                                                                                                                                    |
| 21 | S. S. W. | 9        |  | 29·288               | Raining.  |                                                                                                                                                                       |
| 22 |          | 9        |  | 29·306               | Raining.  |                                                                                                                                                                       |
| 23 |          | 9        |  | 29·320               | Raining.  |                                                                                                                                                                       |
| 24 |          | 9        |  | 29·326               | Raining.  | Midnight. Weather more moderate, less wind and sea.                                                                                                                   |
|    |          |          |  |                      |           |                                                                                                                                                                       |
|    |          |          |  |                      |           |                                                                                                                                                                       |
|    |          |          |  |                      |           |                                                                                                                                                                       |
|    |          | S. S. W. |  | 29·324               | Raining   | Commences with moderate gale and high sea but better appearance in the weather.                                                                                       |
|    | 2        |          |  | 29·336               | Raining.  |                                                                                                                                                                       |
|    | 3        |          |  | 29·346               | Raining.  |                                                                                                                                                                       |
|    | 4        |          |  | 29·353               | Raining.  |                                                                                                                                                                       |
|    | 5        |          |  | 29·356               | Raining.  | 8 A. M. Observed a large circle round the sun.                                                                                                                        |
|    | 6        |          |  | 29·361               | Overcast. |                                                                                                                                                                       |
|    | 7        | S.       |  | 29·365               | Overcast. |                                                                                                                                                                       |
|    | 8        |          |  | 29·415               | Raining.  |                                                                                                                                                                       |
|    | 9        |          |  | 29·440               | Raining.  | Noon. Strong breezes with blinding rain squalls.                                                                                                                      |
|    | 10       |          |  | 29·474               | Overcast. |                                                                                                                                                                       |
|    | 11       |          |  | 29·486               | Overcast. |                                                                                                                                                                       |
|    | 12       |          |  | 29·464               | Raining.  |                                                                                                                                                                       |
|    |          |          |  |                      |           | P. M. Weather fine. Heavy swell from southward.                                                                                                                       |
|    |          |          |  |                      |           |                                                                                                                                                                       |

## CHAPTER IV.

## THE HISTORY OF THE STORM OF THE 10TH TO 15TH NOVEMBER, 1883.

The present storm was generated in the Gulf of Martaban, after the north-east monsoon had been established for more than a month over the north and centre of the Bay. The rains of the south-west monsoon terminated prematurely in Bengal in the last week of September. It is a well-known fact that the commencement of the north-east monsoon on the Coromandel coast is due to the recurvature of the south-west monsoon winds over the south and centre of the Bay. The lower atmospheric current, which is from south-west in the extreme south, at that period changes, through south-east and east in the centre of the Bay, to north-east on the Madras coast. The south-west monsoon current of the year 1883 was unusually weak, and, when it retreated from Bengal, it recurved immediately, and north-east winds were established on the Madras coast in the first week of October. Hence the north-east monsoon rains set in over the Madras Presidency a week or ten days earlier than usual. They gave general, and unusually heavy, rainfall, as is shown by the following table of rainfall at eight of the more important stations in that Presidency.

*Rainfall at eight stations of the Madras Presidency, October 1883.*

| Stations.    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   | 16   | 17   |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Coconada ... | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 1.62 | 2.35 | 0.10 | 0.23 | 1.50 |
| Masulipatam  | 0.30 | ...  | ...  | 0.18 | 0.13 | ...  | ...  | 0.02 | ...  | ...  | ...  | ...  | 0.75 | 2.44 | ...  | 1.47 | 0.31 |
| Madras       | ...  | 4.88 | 0.20 | 0.34 | ...  | 0.01 | 0.08 | ...  | ...  | ...  | 0.48 | 0.36 | 1.81 | 1.51 | 1.06 | 3.40 | 0.57 |
| Salem...     | ...  | ...  | 2.75 | ...  | 0.20 | 0.15 | ...  | ...  | ...  | 0.01 | 1.05 | 0.75 | 0.14 | 0.66 | 1.04 | 1.83 | 0.80 |
| Nellore      | ...  | 0.50 | 0.35 | ...  | ...  | ...  | 0.05 | 0.15 | ...  | ...  | ...  | 0.50 | 0.60 | 4.45 | 0.95 | 0.45 | 2.20 |
| Madura       | ...  | ...  | 0.05 | 0.04 | 0.35 | ...  | ...  | ...  | 0.45 | ...  | ...  | 2.10 | 0.26 | 0.20 | 2.16 | 0.34 | 0.13 |
| Trichinopoly | ...  | ...  | 0.43 | 1.55 | ...  | ...  | ...  | ...  | ...  | 0.70 | ...  | ...  | 0.10 | 0.26 | 0.46 | 0.63 | ...  |
| Tanjore      | ...  | 1.04 | ...  | 0.47 | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 0.06 | ...  | 1.47 | 0.83 | 0.10 | ...  |

| Stations.    | 18   | 19   | 20   | 21   | 22   | 23   | 24   | 25   | 26   | 27   | 28   | 29   | 30   | 31   | Total. | Average. |
|--------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|--------|----------|
| Coconada ... | 0.66 | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 0.90 | 0.25 | 5.70 | 13.31  | 8.60     |
| Masulipatam  | 0.28 | ...  | 0.21 | 0.05 | 0.01 | ...  | 0.24 | 0.03 | ...  | ...  | 0.03 | 1.25 | 0.70 | 4.95 | 13.35  | 8.58     |
| Madras       | 0.16 | 0.10 | 0.12 | 0.37 | ...  | ...  | ...  | 0.02 | 0.16 | 2.89 | 2.12 | 1.54 | ...  | ...  | 22.18  | 10.80    |
| Salem...     | ...  | 1.27 | ...  | 0.08 | ...  | ...  | ...  | ...  | 0.40 | 0.35 | ...  | ...  | ...  | 0.96 | 12.44  | 7.22     |
| Nellore      | 0.30 | ...  | ...  | ...  | ...  | ...  | ...  | ...  | 0.15 | ...  | ...  | 2.55 | 8.20 | 3.00 | 24.40  | 9.84     |
| Madura       | ...  | 0.41 | ...  | 0.07 | ...  | 0.50 | ...  | 1.35 | ...  | 0.25 | 0.12 | ...  | ...  | 0.20 | 8.98   | 8.88     |
| Trichinopoly | ...  | 2.47 | ...  | 0.46 | ...  | ...  | ...  | ...  | ...  | 0.10 | 0.09 | ...  | ...  | 0.69 | 7.94   | 7.86     |
| Tanjore      | 0.08 | 0.06 | 1.70 | ...  | ...  | ...  | ...  | ...  | 0.20 | 0.60 | ...  | 0.05 | ...  | 0.20 | 6.86   | 5.60     |

*Rainfall at eight stations of the Madras Presidency, November 1883.*

| Stations.    | 1     | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12  | 13  | 14  | 15  |
|--------------|-------|------|------|------|------|------|------|------|------|------|------|-----|-----|-----|-----|
| Coconada...  | 6.45  | 3.25 | 0.22 | ...  | 0.05 | ...  | ...  | ...  | ...  | ...  | ...  | ... | ... | ... | ... |
| Masulipatam  | 12.56 | 2.29 | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ...  | ... | ... | ... | ... |
| Madras       | 1.87  | 2.46 | 2.12 | 1.15 | 0.27 | 0.12 | 0.14 | 0.41 | 0.02 | ...  | ...  | ... | ... | ... | ... |
| Salem...     | 0.73  | 0.94 | 0.27 | 1.16 | 0.16 | ..   | 0.02 | 0.01 | 0.75 | 0.06 | ...  | ... | ... | ... | ... |
| Nellore      | 1.00  | 1.60 | 0.45 | 0.60 | 0.05 | 0.95 | ...  | ...  | ...  | ...  | ...  | ... | ... | ... | ... |
| Madura       | 1.95  | 1.80 | 1.08 | 3.00 | ...  | 0.20 | 0.04 | 0.03 | ...  | 0.33 | 2.00 | ... | ... | ... | ... |
| Trichinopoly | ...   | 0.06 | 0.25 | 1.96 | ...  | ...  | 1.44 | ...  | 0.10 | ...  | ...  | ... | ... | ... | ... |
| Tanjore      | ...   | 0.27 | 0.08 | 1.78 | 1.02 | 0.06 | ...  | 0.85 | ...  | ...  | ...  | ... | ... | ... | ... |

| Stations.    | 16  | 17   | 18   | 19   | 20   | 21   | 22  | 23  | 24  | 25  | 26  | 27  | 28  | 29  | 30  | Total. | Average. |
|--------------|-----|------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|--------|----------|
| Cocanada ... | ... | ...  | ...  | ...  | ...  | ...  | ... | ... | ... | ... | ... | ... | ... | ... | ... | 9.97   | 3.59     |
| Masulipatam  | ... | ...  | ...  | ...  | ...  | ...  | ... | ... | ... | ... | ... | ... | ... | ... | ... | 14.85  | 4.11     |
| Madras       | ... | ...  | 0.30 | 4.75 | 1.31 | ...  | ... | ... | ... | ... | ... | ... | ... | ... | ... | 14.92  | 13.40    |
| Salem...     | ... | ...  | 0.25 | 0.01 | ...  | ...  | ... | ... | ... | ... | ... | ... | ... | ... | ... | 4.36   | 2.65     |
| Nellore      | ... | ...  | 0.55 | 0.70 | ...  | ...  | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5.90   | 10.17    |
| Madura       | ... | ...  | 0.20 | ...  | ...  | 0.35 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 10.98  | 5.37     |
| Trichinopoly | ... | 1.26 | ...  | 0.08 | 0.07 | ...  | ... | ... | ... | ... | ... | ... | ... | ... | ... | 5.22   | 5.23     |
| Tanjore      | ... | ...  | 2.90 | 0.02 | 0.17 | 0.48 | ... | ... | ... | ... | ... | ... | ... | ... | ... | 7.63   | 5.54     |

The preceding table shews that rain fell more or less continuously during the whole of October and until the 4th of November, after which a few showers fell until the 9th and 10th, when rain entirely ceased for several days. After the 4th, the north-east monsoon current decreased

in strength, as is shewn by the following return of the wind observations on the Madras coast :—

|              | November average. |         | 1st. |         | 2nd. |         | 3rd. |         | 4th. |         | 5th. |         | 6th. |         | 7th. |         |
|--------------|-------------------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|
|              | Dir.              | Amount. | Dir. | Amount. | Dir. | Amount. | Dir. | Amount. | Dir. | Amount. | Dir. | Amount. | Dir. | Amount. | Dir. | Amount. |
| Vizagapatam. | N83°E             | 2·5     | N    | 2       | N    | 1       | N    | 3       | N    | 3       | NE   | 3       | N    | 4       | NE   | 2       |
| Masulipatam. | N56°E             | 6·0     | NNE  | 9       | SE   | 9       | ENE  | 6       | ENE  | 9       | ENE  | 7       | NE   | 8       | NNE  | 7       |
| Madras.      | N24°E             | 6·8     | WSW  | 5       | SE   | 6       | SE   | 7       | NNE  | 5       | N    | 5       | N    | 6       | E    | 4       |
| Negapatam.   | N37°E             | 5·6     | SW   | ?       | SW   | 0       | WNW  | ?       | NE   | ?       | NNE  | 2       | NE   | 4       | NNE  | 6       |

The preceding observations shew that the north-east winds on the Madras coast were diminishing in force. It is, therefore, probable that the south-west monsoon current over the south of the Bay was much weaker, and that, instead of recurving and blowing strongly on the Madras coast, it was continued over the centre of the Bay as light and variable winds. This supposition is, it will be seen, confirmed by the accounts of the weather contained in the logs of the vessels navigating the Bay to the west of the Andamans at that time. The cyclone did not commence to form until the 9th of November, but the meteorology of the Bay on the 7th and 8th is given to shew the character of the weather prior to the storm.

*7th November.*—The barometer was oscillating at the time slowly over the whole of India, and the distribution of pressure was almost identical with that which had obtained for the previous three or four days, and differed very slightly from the normal. A slight rise of the barometer occurred during the previous 24 hours at the great majority of stations. The barometric changes were, however, of no importance. The barometer was highest in Scind and Rajputana, where the readings averaged 30·05", and was lowest over the south of the Bay, where, as shown by the returns of Negapatam, Trincomalee, Port Blair, and Nancowry, it was slightly below 29·95". The differences of pressure were hence comparatively small over the whole area.

The following table gives the 10 A. M. readings of the barometer,



reduced to sea level and for temperature, at the more important meteorological stations around the Bay :—

| Stations.           | Barometer<br>at 10 A. M.<br>reduced to<br>sea level. | Stations.            | Barometer<br>at 10 A. M.<br>reduced to<br>sea level. |
|---------------------|------------------------------------------------------|----------------------|------------------------------------------------------|
| Saugor Island ..... | 30·028                                               | Chittagong, .....    | 29·994                                               |
| False Point .....   | 30·028                                               | Akyab .....          | 29·975                                               |
| Gppaulpore .....    | 30·016                                               | Diamond Island ..... | 29·970                                               |
| Vizagapatam .....   | 30·014                                               | Port Blair .....     | 29·945                                               |
| Madras .....        | 30·013                                               | Nancowry .....       | 29·943                                               |
| Negapatam .....     | 29·948                                               | Moulmein .....       | 29·958                                               |
| Trincomalee .....   | 29·951                                               | Rangoon .....        | 30·004(?)                                            |
|                     |                                                      | Mergui .....         | 29·956                                               |

The gradients over the Bay were normal in character, pressure decreasing from north to south. The total barometric difference was slightly less than nine-hundredths of an inch. The average barometric difference between the north and south of the Bay in the middle of November is '075". The distribution of pressure over the Bay on the 7th was very approximately normal.

Over the greater part of India, including the whole of Northern and Central India and the North Deccan, the weather was fine and skies clear. These were clouded in Southern India, more especially on the Coromandel coast, where they were generally overcast. Over the whole of the Indian land area, winds were normal in direction. North-westerly to westerly winds prevailed over the greater part of the Gangetic plain, and northerly winds in the Gangetic Delta. Along and near the Coromandel coast, north-easterly humid winds were giving moderate showers of rain. In Burnah, winds varying between east and north-east prevailed. The weather in every part of the Indian area, so far as can be judged from the land observations, was of the usual November, or cold weather, type. There were no signs of the existence of any atmospheric disturbance either in the land or adjacent sea area.

The only indications of the probable early occurrence of stormy weather in the Bay were the lightness and variability of the winds over the centre and south of the Bay, and the rapid and steady decrease in the rainfall of the Madras Presidency.

The following table gives the chief observations taken during the day at the stations subsequently affected by the cyclone:—

| Stations.        | Barometer at A. M. reduced to sea level. | C | since 10 previous | Wind direction |          | Velocity in miles per hour since A. M. | Load moon 10 A. M. | Infal. preceding 24 hours. | Weather.                 |
|------------------|------------------------------------------|---|-------------------|----------------|----------|----------------------------------------|--------------------|----------------------------|--------------------------|
|                  |                                          |   |                   | 10 A. M.       | 4 P. M.  |                                        |                    |                            |                          |
| Nancowry .....   | 29.943                                   | + | .041              | S.             | S.S.W.   | 4                                      |                    | 0.62                       |                          |
| Port Blair ..... | 29.945                                   | + | .003              | S. E.          | S. E.    | 4                                      |                    |                            |                          |
| Diamond Island   | 29.970                                   | + | .033              | E. N. E.       | E.       | 5                                      | 5                  | 0.11                       | Thunder.                 |
| Akyab .....      | 29.975                                   | + | .027              | E. N. E.       | W.       | 2                                      | 1                  | ...                        | Fine.                    |
| Chittagong ...   | 29.994                                   | + | .027              | N. N. E.       | E.       | 2                                      | 1                  | ...                        | Fine.                    |
| Toung-hoo .....  | 29.969                                   | + | .081              | N. W.          | N. W.    | ?                                      | 10                 | ...                        | Threaten-<br>ing weather |
| Bassein .....    | 29.977                                   | + | .037              | E.             | S. E.    | 4                                      | 10                 | 0.02                       | Gloomy.                  |
| Rangoon .....    | 30.004?                                  | + | .068              | E. N. E.       | N. E.    | 3                                      | 10                 | 0.28                       | Cloudy.                  |
| Moulmein .....   | 29.958                                   | + | .073              | E.             | N. N. W. | 2                                      | 9                  | ...                        | Cloudy.                  |
| Mergui .....     | 29.956                                   | + | .015              | N.             | Calm     | 1                                      | 6                  | ..                         | Cloudy.                  |

The information relating to the state of the weather in the Bay on the 7th of November, contained in the logs of vessels navigating the Bay at this period, is given in the following statement:—

| Vessel.            | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable<br>reduced<br>barometer. | Wind.     |        | REMARKS.                                                                                                              |
|--------------------|---------|-----------------|------------------|-----------------------------------|-----------|--------|-----------------------------------------------------------------------------------------------------------------------|
|                    |         |                 |                  |                                   | Dir.      | Force. |                                                                                                                       |
| Mount Stuart ..... | Noon    | 11° 50'         | 91° 50'          | 29.925                            | E.        | ...    | Passing clouds towards noon, heavy rain clouds all round, but cleared away towards sunset. Weather unsettled-looking. |
|                    | 4 P. M. |                 |                  |                                   | E.        | 2      |                                                                                                                       |
|                    | 8 P. M. |                 |                  |                                   | variable. | 3      |                                                                                                                       |
|                    | Midnt.  |                 |                  |                                   | S.        | ...    |                                                                                                                       |
| Kwang Tung         | 4 A. M. |                 |                  | 29.851                            | S. E.     | 2      | Fine weather throughout.                                                                                              |
|                    | 8 A. M. |                 |                  | .909                              | N. E.     | 2      |                                                                                                                       |
|                    | Noon    | 12° 33'         | 93° 6'           | .943                              | N. E.     | 2      | Sea smooth.                                                                                                           |
|                    | 4 P. M. |                 |                  | .921                              | N. E.     | 2      |                                                                                                                       |
|                    | 8 P. M. |                 |                  | .909                              | N. E.     | 2      |                                                                                                                       |
|                    | Midnt.  |                 |                  | .906                              | S. W.     | 2      |                                                                                                                       |

| Vessel.           | Hour.   | Latitude.<br>N. | Longitude. | Probable<br>reduced<br>barometer. | Wind.    |          | REMARKS.                                                                                                                                                                                            |
|-------------------|---------|-----------------|------------|-----------------------------------|----------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   |         |                 |            |                                   | Dir.     | Force.   |                                                                                                                                                                                                     |
| Frank Stafford .. | 4 A. M. |                 |            |                                   | N        | 4        | Fine weather and smooth sea.                                                                                                                                                                        |
|                   | Noon    | 19° 43'         | 88° 15'    | 29.980                            | N.       | 4        |                                                                                                                                                                                                     |
|                   | Midnt.  |                 |            |                                   | N.       | 4        |                                                                                                                                                                                                     |
| Parthenope        | Noon    | 20° 10'         | 89° 51'    | 29.975                            | N.       | Moderate | A. M. Light unsteady breeze, fine, and clear. Noon. Wind very unsteady. Current perceptible, setting to the S. W. 4 P. M. Moderate breeze. 8 P. M. Light breeze and clear, with frequent lightning. |
|                   | Midnt.  |                 |            |                                   | N. W.    | Light.   |                                                                                                                                                                                                     |
| Breadalbane       | Noon    | 20° 55'         | 88° 8'     | 29.975                            | N. N. E. | 0 to 1   | Calm and variable airs throughout, current to S. W.                                                                                                                                                 |
|                   | 4 P. M. |                 |            |                                   | NE by N  | 2 to 3   |                                                                                                                                                                                                     |

The information respecting the weather in the Bay is very limited, and confined to extracts from the logs of five vessels, and to the observations at Port Blair, Nancowry, the coast stations, and on board the light vessels near the entrance to the Hooghly.

Three vessels, the Frank Stafford, Parthenope, and Breadalbane, were near the Head of the Bay. The weather was fine, the sea smooth, and winds light and unsteady. These varied between N. E. and N. W. in direction, and did not exceed force 4 at any time during the day. At Port Blair, the sky, which had been almost clear on the 4th, 5th, and 6th, was clouding over. The air was unusually clear in the morning, but the weather became cloudy and gloomy in the afternoon. No rain fell on this day, nor had any fallen since the 4th. The winds also were extremely light. Only 100.6 miles were registered for the 24 hours preceding 4 P. M., the smallest amount in 24 hours recorded during the month.

The sky had been densely clouded at Nancowry for some days past, and rain in moderate amounts had been recorded on every day. On the 6th .62 inch fell with S. S. W. winds. During the first three days of the month, the winds were from south-east, the normal direction

in November, when the south-west monsoon is recurving over the centre of the Bay, and giving north-easterly monsoon winds and rain to the Coromandel coast. The amount of wind registered at Nancowry on each day of the first week of the month, is given in the following table :—

|                       | Total wind<br>amount of the<br>24 hours previ-<br>ous to 4 p. m. | Rainfall at<br>6 p. m. of the<br>preceding 24<br>hours. | Wind direction<br>10 A. M. |
|-----------------------|------------------------------------------------------------------|---------------------------------------------------------|----------------------------|
| 1st .....             | 46.7                                                             | 0.47                                                    | S. E.                      |
| 2nd .....             | 38.2                                                             | 0.21                                                    | S. E.                      |
| 3rd .....             | 44.0                                                             | 2.86                                                    | E. S. E.                   |
| 4th .....             | 19.5                                                             | 0.41                                                    | S. W.                      |
| 5th .....             | 18.8                                                             | 0.96                                                    | S. W.                      |
| 6th .....             | 17.1                                                             | 0.62                                                    | S. W.                      |
| 7th .....             | 125.4                                                            | 1.14                                                    | S. S. W.                   |
| Average October ..... | 149.7                                                            | ...                                                     | S. 50° W.                  |
| „ November ...        | 117.2                                                            | ...                                                     | S. 29° E.                  |

This shows that, in consequences of atmospheric actions, the nature of which can only be conjectured, the air motion over the south of the Bay was unusually and remarkably feeble during the first week of the month. The moist current advancing northward, instead of curving through south-east and east and arriving as north-east winds charged with vapour on the Coromandel coast, was exceedingly weak for some days in the neighbourhood of the Nicobars. It had also shifted in direction on the 4th, and was proceeding from the south-west directly into the Martaban Gulf. Rain also began to fall in increasing amounts over this and the adjacent parts of the Bay.

The ship Mount Stuart was advancing northwards, a little distance to the west of the Andamans. She was in Lat. 11° 50' N. and Long. 91° 50' at noon, and during the day had very variable winds commencing from N. E. by N. and ending at S. The weather was fine, but the air was charged with moisture. This is shown by the fact, noted by the Captain, that, during the hotter part of the day, when there is undoubtedly much upward movement of the air, heavy rain clouds formed all around, but cleared away again towards sunset.

The Kwang Tung, on the other hand, was to the east of the Andamans in Lat. 12° 33' N. and Long. 93° 6' E. She had fine weather throughout, with light and variable winds during the day of force 2. The wind shifted from S. E. to N. E. and thence to S. W. during the day.

Hence, so far as can be judged from the various meteorological returns, light winds and fine weather prevailed over the greater part of the Bay. The usual change in the direction or recurvature of the south-west monsoon current (which gives a feeble cyclonic circulation to the air over the centre and south of the Bay) was not only much weaker than usual, but was suspended over a part of the area in the neighbourhood of the Nicobar<sup>s</sup> and Andamans, where very light unsteady winds had prevailed for the previous two or three days. There is, however, no evidence in the meteorology of this day of the existence of any local cyclonic circulation, such as might form the initial stage in the development of a cyclonic disturbance or storm.

The observations at Moulmein and Mergui confirm the previous statements, and prove the existence of light variable winds, chiefly from the east and north, on the east coast of the Martaban Sea.

*8th November.*—During the preceding 24 hours, a rapid fall of the barometer had taken place in the Punjab. The amount of the fall was '26" at Mooltan, '13" at Quetta, and '12" at Dera Ismail Khan and Lahore.

It will be seen from the meteorology of the 9th and 10th that this fall was the first indication of the occurrence of a cold weather or north-east monsoon storm in Upper India. It is during these storms that a large portion of the snowfall of the higher Himalayas takes place. In consequence of this rapid fall, pressure was lowest over the Punjab. Sudden and large changes of pressure are a frequent feature of the cold weather in the Punjab. It is not yet quite certain whether the formation of these Punjab areas of low pressure commences simultaneously over the Western Punjab and the adjacent districts of Afghanistan or Belochistan. This appears to be the most probable explanation, but it is not unlikely that some may occasionally form much further to the west, and pass through Afghanistan or Belochistan into the Punjab or Sind. It will, however, presently be seen that this considerable disturbance in the Punjab exercised no appreciable action on the atmospheric circulation in the Bay of Bengal.

The distribution of pressure was somewhat complicated over India itself. Pressure was lowest in the Indus Valley. A broad band of high pressure stretched down the middle of India from Ajmere to Secunderabad, whilst pressure was approximately uniform over the Bay.

The changes of pressure were not accompanied by any immediate marked change in the wind or weather. Skies were clear, and weather fine and dry over all parts of India, except South Burmah and Southern India (more especially the Coromandel Coast), where skies were overcast and occasional showers continued to be received. The amounts which fell at the various rainfall registering stations were very small.

The only alteration in the wind directions that deserves notice occurred at Diamond Island and Akyab, where the wind had shifted round, to south-east. This of course indicated the further northward extension of the south-west monsoon current which had commenced on the 4th at Nancowry.

The following table gives the 10 A. M. reduced barometric readings of the recording stations on the coast of the Bay :—

Stations on west coast of the Bay.      Stations on east coast of the Bay.

| Stations.          | Barometer<br>10 A. M.<br>reduced to<br>sea level. | Stations.            | Barometer<br>10 A. M.<br>reduced to<br>sea level. |
|--------------------|---------------------------------------------------|----------------------|---------------------------------------------------|
| Saugor Island..... | 29·977                                            | Chittagong .....     | 29·953                                            |
| False Point .....  | 29·983                                            | Akyab .....          | 29·930                                            |
| Vizagapatam .....  | 29·976                                            | Diamond Island ..... | 29·930                                            |
| Madras .....       | 29·983                                            | Moulmein .....       | 29·928                                            |
| Negapatam .....    | 29·978                                            | Port Blair .....     | 29·936                                            |
|                    |                                                   | Nancowry .....       | 29·922                                            |

The differences of pressure along the west coast were much smaller than on the 7th, and pressure was very approximately uniform. It was slightly lower at the east coast stations, but, even there, the differences were extremely small.

The following table gives the 10 A. M. observations at stations in the neighbourhood of the area in which the storm was generated :—

| Stations.        | at<br>re-<br>sea<br>level | Change<br>since<br>10 A. M. pre-<br>vious day. | Wind direction.<br>10 A. M. | Velocity in<br>miles per hour<br>since 10 A. M.<br>previous day. | Cloud<br>at 10<br>A. M. pre-<br>c<br>ing 24 hor | Weather. |
|------------------|---------------------------|------------------------------------------------|-----------------------------|------------------------------------------------------------------|-------------------------------------------------|----------|
| Nancowry ... ..  | 29·922                    | ·021                                           | S. W.                       | S. W.                                                            | 7                                               | 1·14     |
| Port Blair ..... | 29·936                    | — ·009                                         | W S. W.                     | W. S. W.                                                         | 5                                               | 0·18     |
| Diamond Island   | 29·930                    | — ·040                                         | E. S. E.                    | S.                                                               | 13                                              | 2·35     |
| Akyab .....      | 29·930                    | — ·045                                         | S. S. E.                    | ?                                                                | 2                                               | 0·16     |
| Chittagong ...   | 29·953                    | — ·041                                         | N.                          | E. S. E.                                                         | 1                                               |          |
| Toungoo .....    | 29·980                    | + ·011                                         | S. W.                       | S. E.                                                            | ?                                               |          |
| Bassein .....    | 29·941                    | — ·036                                         | S. E.                       | S. S. E.                                                         | 4                                               | 0·10     |
| Rangoon .....    | 29·965                    | — ·039                                         | E.                          | S. S. E.                                                         | 2                                               | 0·41     |
| Moulmein .....   | 29·928                    | — ·030                                         | S. E.                       | N. W.                                                            | 2                                               | ...      |
| Mergui .....     | 29·965                    | + ·009                                         | E.                          | S.                                                               | 2                                               | 0·25     |

The information relating to the meteorology of the Bay on the 8th is given in the following table :—

| Vessels.        | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Winds.    |              | REMARKS.                                                                                                                                                                          |
|-----------------|---------|-----------------|------------------|-----------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |         |                 |                  | Dir.      | Force.       |                                                                                                                                                                                   |
| Mount Stuart    | 4 A. M. |                 |                  | S. to W.  | 2 to 3       | Sea smooth. Passing showers during day.                                                                                                                                           |
|                 | Noon    | 12° 17'         | 92° 00'          | 29-925    | 1 to 2       | Heavy black clouds all round, with momentary puffs from N. W., and smart showers towards midnight. There was lightning in the N. W. during the morning.                           |
|                 | 4 P. M. |                 |                  | W to S.E. | 1            | Midnight. Weather was a little squally.                                                                                                                                           |
|                 | Midnt.  |                 |                  | W to NW   | 2 to 4       |                                                                                                                                                                                   |
| Scottish Hill   | Noon    | 12° 31'         | 25° 29'          | 29-920    | E. to W.     | Light airs and calms.                                                                                                                                                             |
|                 | P. M.   |                 |                  |           |              | Wind very variable.                                                                                                                                                               |
|                 | 3 P. M. |                 |                  |           |              | Sky dull lead colour.                                                                                                                                                             |
|                 | Midnt.  |                 | 29-900           |           |              |                                                                                                                                                                                   |
| Kwang Tung      | 4 A. M. |                 | 29-901           | N. W.     |              |                                                                                                                                                                                   |
|                 | 8 A. M. |                 | 926              | N. W.     |              |                                                                                                                                                                                   |
|                 | Noon    | 15° 11'         | 92° 6'           | 893       | N. W.        | Smooth sea.                                                                                                                                                                       |
|                 | 4 P. M. |                 | 901              | N. W.     | 4 to 5       |                                                                                                                                                                                   |
|                 | 8 P. M. |                 | 871              | N. W.     | do.          |                                                                                                                                                                                   |
|                 | Midnt.  |                 | 903              | N. W.     | do.          |                                                                                                                                                                                   |
| Frank Stafford. | 4 A. M. |                 |                  | NW by N   |              | Fine weather, smooth sea.                                                                                                                                                         |
|                 | 8 A. M. |                 |                  | North.    |              | Very sharp lightning in the S. E. during the night.                                                                                                                               |
|                 | Noon    | 20° 16'         | 90° 28'          | 29-974    | N. N. W      |                                                                                                                                                                                   |
|                 | 8 P. M. |                 |                  |           | N. N. W      |                                                                                                                                                                                   |
|                 | Midnt.  |                 |                  |           | N. N. W      |                                                                                                                                                                                   |
| Breadalbane     | Noon    | 21° 00'         | 88° 18'          | 29-975    | N.           | Sunrise. Moderate breeze from N., dying away in the afternoon to a calm.                                                                                                          |
| Parthenope      | Noon    | 21° 2'          | 88° 52'          | 29-975    | N. W. gentle | A. M. Light breeze, fine and clear. 8 A. M. Moderate breeze and hazy. Noon. Less wind, current setting west. 4 P. M. Light airs. 8 P. M. Calm. Midnight. Gentle breeze and clear. |
|                 | Midnt.  |                 |                  |           | N. by E.     |                                                                                                                                                                                   |

The Nancowry returns prove that the south-west winds in the neighbouring part of the Bay began to increase in strength. The sky was overcast during the day, and 1·14 inches of rain were registered for the 24 hours preceding 1 p. m. The wind during the previous night had shifted round to W. S. W. at Port Blair, and blew steadily during the day, and somewhat more strongly than on either of the previous two days. The sky had clouded over, and rain in small amounts began to fall. ·18 inch was recorded at 4 p. m.

The weather was slightly disturbed in South Burmah. Passing showers fell during the day, and thunderstorms occurred in one or two cases. East-south-east winds set in at Diamond Island and at Rangoon. In the interior of Burmah, winds were not so steady as they had been previously. The sky was overcast at Mergui, winds were light and variable, and veered from east to south during the day.

The prevalence of S. W. winds at Port Blair and Nancowry, and of E. and S. E. winds at the Burmah stations, shews that there was on this day no well-defined cyclonic circulation, or centre of large disturbance, in the Martaban Gulf.

The logs of the vessels in the Bay for the day indicate that similar conditions obtained to those of the preceding day.

The Frank Stafford, Parthenope, and Breadalbane were at the Head of the Bay near the entrance to the Hooghly. They experienced fine weather, light winds and calms, and a smooth sea. The Kwang Tung had steamed to the north-west during the previous 24 hours, and was in Lat. 15° 11' N. and Long. 92° 6' E. at noon. Her log shows that there was no perceptible current in this part of the Bay at this time, an almost conclusive proof of the absence of any strong atmospheric cyclonic circulation in the neighbourhood. The ships Mount Stuart and Scottish Hill were a little to the west of the Andamans. The former was in Lat. 12° 17' N. and Long. 92° E. Her log states that the sea was smooth, but that the weather was becoming unsettled. She began to experience puffs or slight squalls from the north-west. The sky during the day was covered with dense black clouds, and occasional showers fell, which became heavier and "smarter" as the day advanced. The winds were very variable, veering from S. through W. thence to S. E. and back to W. and N. W. The log of the Scottish Hill, which was about 180 miles to the west of the Mount Stuart, gives similar information. The winds were very light and variable, veering round the compass, the sky was heavily clouded, and the weather dull and gloomy.

Hence the various observations indicate the continuance and slight development of the conditions which, according to our experience of the meteorology of the Bay, precede the formation of cyclonic storms. On the other hand, they give no evidence of the existence at this time of a



cyclonic circulation in the Martaban Gulf. South-westerly winds were increasing in force over the south-east of the Bay, and were being continued much further north than is usual in the month of November. To the west of the Andamans, winds were exceedingly light and variable, and such as to show that the south-west winds advancing northwards were not being continued in that direction near the earth's surface. The clouding over of the sky, the commencement of showers increasing in intensity and accompanied with slight squalls, indicate clearly that ascensional movement on a large scale was commencing over that area, and giving rise to its usual result when it is partly fed and maintained by a moist current, namely, rainfall increasing in intensity, which, by a known law of rainfall, tends to become concentrated over a limited area.

*9th November.*—There are no new features of interest in the meteorology of the Indian land area. Pressure continued to give way in all parts of India. The decrease was greatest in Sind, Rajputana, and the Punjab. The area of barometric depression over the Indus valley was now very distinctly marked. It had as yet exercised no marked influence in the weather of Upper India. The winds were, however, drawing round in the Punjab and neighbouring districts, and indicated a feeble cyclonic air circulation over Upper India. The ascensional movement which necessarily accompanied it, had not given rise to the formation of cloud, except over the North-Western Himalayas.

Over the whole of Bengal and the North-Western and Central Provinces, the air motion was very slight, averaging only 1 to 2 miles per hour.

In Southern India the weather conditions were unchanged. Cloudy skies continued in the Madras Presidency, and a few occasional showers of no importance were received.

The observations at the coast stations of the Bay of Bengal present the same features as hitherto. The baric gradients were apparently normal in direction, but somewhat smaller than usual, and the differences of pressure comparatively small. The most important feature was the weakness of the north-easterly winds on the Coromandel coast. This is shown by the following statement:—

| Stations.    | Amount of wind<br>in miles per hour<br>since 10 A. M.<br>previous day. | Average daily<br>amount of wind<br>(miles per hour)<br>in November. |
|--------------|------------------------------------------------------------------------|---------------------------------------------------------------------|
| Vizagapatam  | 2                                                                      | 2.5                                                                 |
| Masulipatam  | 2                                                                      | 6.0                                                                 |
| Madras ..... | 5                                                                      | 6.8                                                                 |
| Negapatam    | 3                                                                      | 5.6                                                                 |
| Trichinopoly | 1                                                                      | 4.6                                                                 |
| Madura ..... | 3                                                                      | 4.1                                                                 |

The information respecting the weather in the Bay is as hitherto meagre.

The following are the observations taken at the land observatories in the neighbourhood of the cyclonic disturbance :—

| Stations.        | Barometer at 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Wind direction. |          | Velocity in miles per hour since 10 A. M. previous day. | Cloud amount at 10 A. M. | Rainfall at 10 A. M. preceding 24 hours. | Weather.       |
|------------------|---------------------------------------------|-------------------------------------|-----------------|----------|---------------------------------------------------------|--------------------------|------------------------------------------|----------------|
|                  |                                             |                                     | 10 A. M.        | 4 P. M.  |                                                         |                          |                                          |                |
| Nancowry .....   | 29·897                                      | —·025                               | S. W.           | S. W.    | 8                                                       | 9                        | 2·02                                     | Gloomy.        |
| Port Blair ..... | 29·894                                      | —·042                               | W.              | W. S. W. | 7                                                       | 9                        | 0·17                                     |                |
| Diamond Island   | 29·900                                      | —·030                               | E. S. E.        | E. S. E. | 10                                                      | 5                        | 1·41                                     | Fine.          |
| Chittagong ...   | 29·921                                      | —·032                               | E. N. E.        | N. N. W. | 1                                                       | 2                        | ...                                      | Fine.          |
| Toungahoo .....  | 29·873?                                     | —·107?                              | N. W.           | N. W.    | ?                                                       | 10                       | 1·10                                     | Thunder storm. |
| Bassein .....    | 29·924                                      | —·017                               | E. S. E.        | S. E.    | 5                                                       | 10                       | 0·17                                     | Gloomy.        |
| Rangoon .....    | 29·942                                      | —·023                               | E. S. E.        | S. S. E. | 4                                                       | 10                       | 0·69                                     | Showery        |
| Moulmein .....   | 29·898                                      | —·030                               | N. E.           | E. S. E. | 2                                                       | 1                        | 0·71                                     | Showery        |
| Mergui .....     | 29·995?                                     | +·030?                              | S. S. E.        | S. S. E. | 2                                                       | 10                       | ...                                      | Gloomy.        |

The Nancowry returns shew that a fall of '03" had occurred in the barometer. The winds were slightly stronger, but were only blowing with an average velocity of 8 miles per hour, the normal rate at that station in November. The sky was overcast, and rain continued to fall in moderate amounts. 2·02 inches were registered for the 24 hours preceding 10 A. M.

Heavy rain was apparently falling at this time to the north-east of the Nicobars and to the east of the Andamans. There is no direct evidence of this statement. The first indications, however, of cyclonic motion are presented by the Port Blair observations of this day. The barometer was falling at that station, the sky was, as on the 8th, densely clouded, and heavy rain began to fall in the afternoon and evening. The wind shifted round to west at 10 A. M. and to W. S. W. at 4 P. M. On the opposite coast of the Martaban Gulf, the sky was overcast, but little rain fell. In South Burmah, the weather was fine with passing clouds, which gave occasional showers. The sea was slight at Diamond Island. Hence the evidence is fairly complete that there was, as on the 8th, no definite cyclonic circulation, although there were slight indications of its commencement.

The shift of wind at Port Blair, and the occurrence of rainfall with squalls to the west of it, render it almost certain that the usual actions, which initiate the formation of an atmospheric whirl on a large scale, were now commencing. The meteorology of the 10th will show that the formation probably proceeded slowly during the afternoon and night of the 9th, but afterwards with increasing rapidity.

The meteorological information relating to the weather in the Bay of Bengal on the 9th, extracted from the logs of vessels, is tabulated below :—

| Vessel.         | Hour.   | Latitude.<br>N.               | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.   |          | REMARKS.                                                                                                                                                                                     |
|-----------------|---------|-------------------------------|------------------|---------------------------------------|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                 |         |                               |                  |                                       | Dir.     | Force.   |                                                                                                                                                                                              |
| Scottish Hill   | Noon    | 13° 1'                        | 89° 42'          | 29.920                                | N. W.    | 1        | Light airs and calms.                                                                                                                                                                        |
|                 | 4 P. M. |                               |                  |                                       | W.       | 0        | Very sultry, clouds in light masses.                                                                                                                                                         |
|                 | 8 P. M. |                               |                  |                                       | N. N. W. | 0        | Sky dull lead colour.                                                                                                                                                                        |
|                 | Midnt.  |                               |                  | .890                                  | W.       | 2        |                                                                                                                                                                                              |
| Mount Stuart    | Noon    | 13° 8'                        | 92° 2'           | 29.875                                |          | 0        | Sky overcast with heavy clouds all round. Weather unsettled. There was a good deal of lightning in the sky this morning and towards midnight, mostly in the N. W. Midnight. Weather showery. |
|                 | 8 P. M. |                               |                  |                                       | N. E.    | 1 to 3   |                                                                                                                                                                                              |
|                 | Midnt.  |                               |                  |                                       | E. S. E. | 1 to 2   |                                                                                                                                                                                              |
| Kwang Tung      | 4 A. M. |                               |                  | 29.924                                | N. E.    | 5        |                                                                                                                                                                                              |
|                 | 8 A. M. |                               |                  | .911                                  | N. E.    | 5        |                                                                                                                                                                                              |
|                 | Noon    | 17° 37'                       | 90° 20'          | .936                                  | N. E.    | 5        | Current during the 24 hours, S. 12° E. 15 miles.                                                                                                                                             |
|                 | 4 P. M. |                               |                  | .883                                  | N. E.    | 5        | Sea smooth.                                                                                                                                                                                  |
|                 | 8 P. M. |                               |                  | .856                                  | N.       | 5        |                                                                                                                                                                                              |
|                 | Midnt.  |                               |                  | .891                                  | N. E.    | 5        |                                                                                                                                                                                              |
| Satara .....    | Noon    | Anchored at Gopaulpore Roads. |                  | 29.950                                | E. by N. | 2        | Light breeze and fine clear weather.                                                                                                                                                         |
|                 | 4 P. M. |                               |                  | .840                                  | ...      | 1        | Light airs and fine.                                                                                                                                                                         |
|                 | 8 P. M. |                               |                  | .880                                  | ...      | 1        |                                                                                                                                                                                              |
|                 | Midnt.  |                               |                  | .870                                  | N E by E | 3        | Gentle breeze and fine.                                                                                                                                                                      |
| Frank Stafford. | 4 A. M. |                               |                  |                                       | N.       | 2        |                                                                                                                                                                                              |
|                 | 8 A. M. |                               |                  |                                       | ...      | 2        | Fine and smooth sea.                                                                                                                                                                         |
|                 | Noon    | 21° 03'                       | 90° 10'          | 29.935                                | ...      | 0        |                                                                                                                                                                                              |
|                 | 4 P. M. |                               |                  |                                       | N. W.    | 2        |                                                                                                                                                                                              |
| Parthenope      | Noon    | Near the Sand heads.          |                  | 29.930                                | N.       | Moderate | A. M. Light breeze and clear. Noon. Moderate breeze and hazy.                                                                                                                                |
| Breadalbane     | Noon    | Near the Sand heads.          |                  | 29.935                                | N.       |          | Calms and light airs from north throughout.                                                                                                                                                  |
|                 | 4 P. M. |                               |                  |                                       | N.       | 1        | Sea smooth and smart showers in the latter part of the day.                                                                                                                                  |
|                 | 8 P. M. |                               |                  |                                       | Calm.    | 0        |                                                                                                                                                                                              |

✓ The Parthenope and Breadalbane, near the Sand Heads, had light airs and calms during the day. The ship Frank Stafford (in Lat.  $21^{\circ} 3' N$ . Long.  $90^{\circ} 10' E$ .) experienced gentle northerly winds with fine weather and a smooth sea.

The S. S. Kwang Tung had advanced 200 miles to the N. W., and was at noon in Lat.  $17^{\circ} 37' N$ . and Long.  $90^{\circ} 20' E$ . She experienced steady north-east winds of moderate force (5) during the day. The ships Mount Stuart and Scottish Hill were proceeding very slowly up the Bay, and had only made about 50 miles during the 24 hours preceding noon. The former was in Lat.  $13^{\circ} 8' N$ . and Long.  $92^{\circ} 2' E$ ., and experienced similar weather to that of the preceding day. The sea was smooth as hitherto. The sky was covered with dense clouds, and heavy showers fell, more especially in the afternoon. The Scottish Hill was in the same latitude, but 160 miles further to the west. She had calms during the greater part of the day. The weather was very sultry. The air was apparently almost saturated with moisture. The sky was covered with clouds, and had an ominous appearance suggestive of bad weather.

The observations of the 9th shew that no atmospheric whirl had been initiated as yet in the Gulf of Martaban. Several of the conditions necessary for the formation of a cyclonic disturbance were present. Winds were light and variable over a considerable portion of the Bay. A strong humid current was advancing over the south of the Bay into the Gulf of Martaban, and was giving moderately heavy rain in the neighbourhood of the Andamans and Nicobars. The rainfall had hitherto been too diffused to initiate a large cyclonic disturbance. It was, however, increasing in amount, and becoming more concentrated in character, the one additional condition now apparently required for the establishment of a large atmospheric whirl.

10th November.—During the previous 24 hours, a further barometric fall occurred throughout the greater part of India. The fall was not so general as on the 8th and 9th, and was much smaller in amount. Pressure was very considerably below the normal over the whole country. The distribution of pressure was generally similar to that which obtained on the morning of the 9th. The area of lowest pressure included the south-western districts of the Punjab and Rajputana, over which there was a distinctly marked cyclonic circulation of the air. In the south of the Punjab, cloud had formed to a considerable extent, whilst, in the north-western Himalayas, thunder-storms with rain had occurred over the lower ranges, and snow had fallen on the higher ranges.

In the North West Provinces, Bengal, the Central Provinces, Central India, Bombay, and the northern districts of Madras, the sky was, as it had been for some time, clear, and the weather fine and settled, but un-

usually dry for the season. The sky was clouded on the Madras coast, but rain had now ceased to fall, as is shewn by the data given in the table on p. 130. The winds on the Madras coast were approximately normal in direction, varying between N. and N. N. W., but were unusually weak.

Hence the effect of the deflexion of the south-west monsoon current from its usual course at this time, which had been previously indicated by the light winds experienced by the Mount Stuart and Scottish Hill to the west of the Andamans, had now extended across the centre of the Bay to the Coromandel coast, over the whole of which area light unsteady winds were blowing. Pressure was very uniform round the north and west coasts of the Bay, as is shown by the following:—

|                     |        |                   |        |
|---------------------|--------|-------------------|--------|
| Saugor Island ..... | 29.929 | Vizagapatam ..... | 29.957 |
| False Point .....   | 29.951 | Madras .....      | 29.960 |

The following table gives the observations at the land stations for the day:—

| Stations.        | Barometer at 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Wind direction. |          | Velocity in miles per hour since 10 A. M. previous day. | Cloud amount. | Temperature 10 A. M. 1 P. M. 24 hours. | Weather.  |
|------------------|---------------------------------------------|-------------------------------------|-----------------|----------|---------------------------------------------------------|---------------|----------------------------------------|-----------|
|                  |                                             |                                     | 10 A. M.        | 4 P. M.  |                                                         |               |                                        |           |
| Nancowry .....   | 29.856                                      | — .041                              | S. W.           | S. W.    | 8                                                       |               | 1.16                                   | Showery.  |
| Port Blair ..... | 29.850                                      | — .044                              | N. N. W.        | W. N. W. | 7                                                       |               | 0.30                                   | Gloomy.   |
| Diamond Island   | 29.917                                      | + .017                              | E. S. E.        | E. S. E. | 12                                                      | 10            | 0.65                                   | Gloomy.   |
| Chittagorg ...   | 29.915                                      | — .006                              | N.              | N. W.    | 1                                                       |               |                                        | Fine.     |
| Tounghoo .....   | 29.905?                                     | + .032?                             | N. W.           | N. W.    | ?                                                       |               | 0.22                                   | Gloomy.   |
| Bassein .....    | 29.917                                      | — .007                              | N. E.           | S. S. .  | 4                                                       |               | 0.18                                   | Overcast. |
| Rangoon .....    | 29.920                                      | — .022                              | N. E.           | E. S. E. | 4                                                       |               | 0.85                                   | Showery.  |
| Moulmein .....   | 29.871                                      | — .027                              | E. N. E.        | S. E.    | 2                                                       |               |                                        | Showery   |
| Mergui .....     | 29.868?                                     | — .127?                             | E. S. E.        | E.       | 1                                                       | 10            | 0.65                                   | Gloomy.   |

The preceding observations establish that a considerable fall of the barometer had taken place during the previous 24 hours. The fall amounted to .04" at Nancowry and Port Blair, .03" at Moulmein, and .02" at Rangoon, and was greatest at Port Blair. Westerly winds of the same average strength as on the 9th had prevailed during the

previous 24 hours at Nancowry. The sky was densely clouded and moderate rain was falling. 1·16 inches of rain were registered at 10 A. M. At Port Blair, the wind had shifted round to north-west, but was not as yet blowing strongly. Rain was falling, but the amount registered up to 10 A. M. of the 10th was small. In South Burmah, the sky had become overcast, and the weather gloomy and threatening, more especially at Diamond Island and Toungoo. Less rain, however, fell on the Burmah coast than had been received on the previous day. It thus again appears probable, if not certain, that the rainfall was becoming more concentrated over a smaller area than hitherto, a favourable, if not a necessary, condition, according to the condensation theory, for the development of an atmospheric whirl.

These observations also show that cyclonic circulation had been initiated, and was now established over the centre and north of the Gulf of Martaban, and the adjacent part of the Bay; and that the central depression or centre of disturbance, as determined by the fall of the barometer, the amount of rain, and the velocity of the wind, was nearest to Port Blair, and to the east of it.

Hence it is evident that, although the conditions for the formation of a whirl had been present for some days, it was only on the 10th that the meteorological observations at the nearest land stations gave clear indications of its existence.

The information contained in the meteorological abstracts from the logs of vessels is tabulated below :—

| Vessel.       | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable reduced barometer. | Winds.   |        | REMARKS.                                                                                                              |
|---------------|---------|-----------------|------------------|-----------------------------|----------|--------|-----------------------------------------------------------------------------------------------------------------------|
|               |         |                 |                  |                             | Dir.     | Force. |                                                                                                                       |
| Scottish Hill | 4 A. M. | 13° 31'         | 89° 40'          | 29·910                      | N.       | 1      | Light airs and calms.                                                                                                 |
|               | 8 A. M. |                 |                  |                             | N. E.    | 1      | Winds very variable.                                                                                                  |
|               | Noon    |                 |                  |                             | N. W.    | 1      | Light airs and calms.                                                                                                 |
|               | 4 P. M. |                 |                  |                             | N. N. W. | 2      | Squally and dirty.                                                                                                    |
|               | 8 P. M. |                 |                  |                             | N. N. E. | 3      | Arched rain squalls.                                                                                                  |
|               | Midnt.  |                 |                  |                             | ·890     | N. W.  | 3                                                                                                                     |
| Mount Stuart  | 4 A. M. | 13° 55'         | 91° 31'          | 29·865                      | N. E.    | 1 to 0 | Sea moderate with light westerly swell.                                                                               |
|               | 8 A. M. |                 |                  |                             | ...      | 3 to 4 | Light fleecy clouds.                                                                                                  |
|               | Noon    |                 |                  |                             | ...      | ...    | Lightning in the N.W.                                                                                                 |
|               | 4 P. M. |                 |                  |                             | ...      | 4      | Towards the afternoon, weather began to be squally. At sunset, sharp squalls and squally-looking all round. Midnight. |
|               | 8 P. M. |                 |                  |                             | ·805     | ...    | Showery.                                                                                                              |
|               | Midnt.  |                 |                  |                             | E. by N. | ...    |                                                                                                                       |

| Vessel.              | Hour.   | Latitude.<br>N.             | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.   |        | REMARKS.                                                                           |
|----------------------|---------|-----------------------------|------------------|---------------------------------------|----------|--------|------------------------------------------------------------------------------------|
|                      |         |                             |                  |                                       | Dir.     | Force. |                                                                                    |
| Satara .....         | 4 A. M. |                             |                  | 29.870                                | N. N. E. | 5      | Fresh breeze and fine.                                                             |
|                      | 8 A. M. |                             |                  | .940                                  | E. N. E. | 4      | Moderate breeze & fine.                                                            |
|                      | Noon    | 17° 56'                     | 88° 45'          | .890                                  | NE by E. | 5      | Fresh breeze and fine throughout. Current during previous 24 hours, north 4 miles. |
|                      | 4 P. M. |                             |                  | .810                                  | N. E.    | 4      | Moderate breeze and fine.                                                          |
|                      | 8 P. M. |                             |                  | .860                                  | E. by S. | 2      | Light breeze and fine clear weather.                                               |
|                      | Midnt.  |                             |                  | .860                                  | E. N. E. | 2      | Same wind and weather.                                                             |
| Kwang Tung           | 4 A. M. |                             |                  | 29.942                                | N. E.    | 5      |                                                                                    |
|                      | 8 A. M. |                             |                  | .899                                  | N.       | 4      |                                                                                    |
|                      | Noon    | 20° 00'                     | 88° 40'          | .920                                  | N.       | 3      | Current S. 32° E. 24 miles.                                                        |
|                      | 4 P. M. |                             |                  | .859                                  | N.       | 3      | Sea smooth.                                                                        |
|                      | 8 P. M. |                             |                  | .904                                  | Calm.    |        |                                                                                    |
|                      | Midnt.  |                             |                  | .934                                  | Calm.    |        |                                                                                    |
| Frank Staf-<br>ford. | 4 A. M. |                             |                  |                                       | N. N. W. | 2      |                                                                                    |
|                      | Noon    | 21° 16'                     | 89° 20'          | 29.915                                | ...      | 2      | Fine, and smooth sea.                                                              |
|                      | Midnt.  |                             |                  |                                       | ...      | 2      | Lightning during the night.                                                        |
| Chanda .....         | Noon    | Hughly River                |                  | 29.910                                | E. N. E. | 2      |                                                                                    |
|                      | 4 P. M. |                             |                  | .830                                  | E. N. E. | 4      |                                                                                    |
|                      | 8 P. M. |                             |                  | .870                                  | Calm.    | ...    |                                                                                    |
|                      | Midnt.  |                             |                  | .910                                  | E.       | 2      |                                                                                    |
| Mahratta ...         | 4 P. M. | Passing San-<br>gor Island  |                  | 29.820                                | E.       | 2      | Fine weather.                                                                      |
|                      | 8 P. M. |                             |                  | .900                                  |          | 0      | Clear sky but slightly hazy.                                                       |
|                      | Midnt.  |                             |                  | .920                                  | N. N. E. | 2      |                                                                                    |
| Parthenope           | Noon    |                             |                  | 29.915                                | N.       |        | A. M. Light breeze and hazy weather.                                               |
|                      | 4 P. M. | Passing San-<br>gor Island. |                  |                                       | Calm.    |        | P. M. Wind unsteady with gusts and calms. Midnight. Wind north and light.          |

The observations given in the ships' logs, although not numerous, confirm the information of the land observations given above.

The Frank Stafford and Kwang Tung, north of Lat.  $20^{\circ}$  N. and near the Head of the Bay, met with light northerly winds or calms and a smooth sea. The Mount Stuart and Scottish Hill were passing very slowly up the Bay at this time. The former was in Lat.  $13^{\circ} 56'$  N. and Long  $91^{\circ} 31'$  E., and observed several of the evidences of cyclonic formation in its neighbourhood. The area of heavy rainfall, as already noticed, had contracted. This explains the fact mentioned in her log that in the morning there were only a few light clouds in the sky. The weather, however, rapidly changed during the day, and became squally in the afternoon. Sharp squalls were experienced at sunset. The barometer was also falling rather rapidly. Winds were from north, and increased in strength from 1 to 4 during the day, indicating the rapid increase of indraught. The Scottish Hill was 120 miles further to the west, and had winds ranging between N. E. and N. W. during the day. They were very light and variable during the earlier part of the day, but the weather became squally towards the evening, and arched rain squalls passed over the ship at 8 p. m. The Satara, which was passing from Gopalpore to Rangoon, was in Lat.  $17^{\circ} 56'$  N. and Long.  $88^{\circ} 45'$  E. at noon. The winds varied during the day between N. N. E. and E. N. E., but decreased in strength during the afternoon. She experienced light breezes and fine clear weather throughout the day. The Chanda and Marhatta left Saugor in the evening, and had fine weather and a clear sky.

Hence, except in the neighbourhood of the Andamans, weather was fine. A definite cyclonic circulation had been established to the east of the Andamans between 10 a. m. of the 9th and 10 a. m. of the 10th. The area of rainfall had for some time contracted, and the rainfall had intensified over the diminished area. Winds of indraught had hence been established, and were increasing in force. This proceeded slowly at first, but, during the evening of the 10th and morning of the 11th, it went on more rapidly, and there was a perfectly well-defined cyclonic circulation, or large atmospheric whirl, established in that part of the Bay on the morning of the 11th November.

• 11th November.—During the previous 24 hours the barometer had risen rapidly over Northern and Central India. The increase of pressure was due to the filling up of the depression in the Punjab and neighbouring districts. The rise of the barometer at Peshawar and Rawal Pindi was  $2''$ . The depression had given a large amount of rain over the Punjab, and stormy weather over the north-west Himalayas, on the higher parts of which much snow had fallen. Amongst the heaviest rain-



falls during the previous 24 hours were the following:—Simla 2·15 inches, Peshawar 1·22 inches, and Rawal Pindi 1·20 inches.

The sky was overcast, and the weather unusually cold, in Upper India. The winds over a large part of Northern India continued to indicate feeble cyclonic circulation about a centre in the north-eastern districts of Sind. Over the whole of Bombay (excluding Sind), Bengal, the Central Provinces, and Central India, the weather was fine, skies cloudless, and the winds blowing from the usual quarter.

Round the coast of the Bay, from Saugor Island to Madras, the differences of pressure were unusually small. The following statement gives the 10 A. M. reduced readings at the more important stations:—

|                     |        |
|---------------------|--------|
| Saugor Island ..... | 29·940 |
| False Point .....   | 29·955 |
| Vizagapatam .....   | 29·945 |
| Madras .....        | 29·948 |

The winds at the Bengal stations near the Head of the Bay blew from directions between north and north-east, the easterly component being probably due to the cyclonic circulation in the middle of the Bay. They were very light. On the Madras coast, the winds were not only more northerly than usual, but were unusually feeble. The data are given in the following table:—

| Stations.      | Amount of wind<br>in miles per<br>hour since 10<br>A. M. previous<br>day. | Daily average<br>amount of wind<br>(miles per hour)<br>of November. |
|----------------|---------------------------------------------------------------------------|---------------------------------------------------------------------|
| Vizagapatam.   | 1                                                                         | 2·5                                                                 |
| Masulipatam.   | 3                                                                         | 6·0                                                                 |
| • Madras ..... | 5                                                                         | 6·8                                                                 |
| Negapatam .    | 2                                                                         | 5·6                                                                 |
| Salem .....    | 2                                                                         | 3·6                                                                 |
| Madura .....   | 2                                                                         | 4·1                                                                 |

Over the Coromandel coast, the weather was fine with passing clouds, and rain had entirely ceased.

The following table gives the observations taken at the recording stations in the neighbourhood of the disturbance:—

| Station        | Barometer at 10 A. M. reduced | Change A. M. | Wind direction | Force    | Locality in miles per hour | Direction of rain | 10 A. M. rainfall at | Remarks           |
|----------------|-------------------------------|--------------|----------------|----------|----------------------------|-------------------|----------------------|-------------------|
| Nancowry ...   | 29.83                         | —0.020       | S. W.          | S. W.    |                            |                   | 0                    | Fine.             |
| Port Blair ... | 29.73                         | —0.000       | W. N. W.       | W. S.    |                            |                   | 9 3.40               | Overcast and rain |
| Diamond Island | 29.83                         | —0.000       | W. N. W.       | E. N.    | 1                          |                   | 2                    |                   |
| Chittagong     | 29.93                         | —0.000       | N.             | W. N.    |                            |                   |                      | Fine.             |
| Toungoo ...    | 29.80                         | —0.000       | N. W.          | N. W.    | ?                          |                   |                      | Gloomy.           |
| Bassein ...    | 29.80                         | —0.000       | N. N. W.       | N. N.    |                            |                   | 1.12                 | Overcast          |
| Rangoon ...    | 29.91                         | —0.000       | N. E.          | N. E.    |                            |                   |                      | Showery           |
| Moulmein ...   | 29.38                         | —0.000       | N.             | E. S. E. |                            |                   |                      | Fine.             |
| Mergu          | 29.85                         | —0.010       | W. S. W.       |          |                            |                   |                      |                   |

These observations show that the barometer had fallen considerably at Port Blair, and to a less extent at Nancowry and Diamond Island. The cause of this is also evident from the observations. Heavy rain had fallen at Port Blair and the neighbourhood. Port Blair registered 3.9 inches at 10 A. M., Nancowry 2.90 inches, and Diamond Island 1.12 inches. The rainfall on the Burmese coast was smaller than on the previous day. Hence the evidence indicates that the rainfall was more concentrated than hitherto, and was falling mainly over an area near to and including Port Blair. This is confirmed by the fact that cyclonic circulation of the air was now fully established. Winds were S. W. at Nancowry, E. S. E. at Mergui, E. N. E. at Diamond Island, and W. N. W. at Port Blair. They were increasing in force rapidly, but were as yet of moderate strength. The wind directions indicate that the centre of the cyclonic circulation was to the east-north-east of Port Blair. It is not possible to infer its position with any approach to exactness from the observations, but we are probably not far from the truth in placing it in Lat.  $13^{\circ} 30' N.$  and Long.  $94^{\circ} 15' E.$

As the vessels which have contributed meteorological data were all to the west and north of the Andamans, they only furnish information

of the weather in the outer portion of the north-west quadrant of the cyclonic circulation.

The following table gives the whole of the information contained in their logs respecting the weather in the Bay on the 11th :—

| Vessel.       | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.              |          | REMARKS.                                                                                                                 |
|---------------|---------|-----------------|------------------|---------------------------------------|---------------------|----------|--------------------------------------------------------------------------------------------------------------------------|
|               |         |                 |                  |                                       | Dir.                | Force.   |                                                                                                                          |
| Scottish Hill | 4 A. M. |                 |                  |                                       |                     |          | Dirty rain squalls.                                                                                                      |
|               | 8 A. M. |                 |                  |                                       | N. E.               | 4        | No sea.                                                                                                                  |
|               | Noon    | 14° 08'         | 90° 33'          | 29·850                                | to                  | 4        | Heavy rain squalls and hail.                                                                                             |
|               | 4 P. M. |                 |                  |                                       | N. W.               | 5        | Cloudy, gloomy sky.                                                                                                      |
|               | 8 P. M. |                 |                  |                                       | N. N. W.            | 2        | 6 P. M. Heavy swell from N. E.                                                                                           |
|               | Midnt.  |                 |                  | ·870                                  | N.                  | 5        | Scud from N. E. and N. N. E. Wind shifting in squalls.                                                                   |
| Mount Stuart  | 4 A. M. |                 |                  |                                       | E. N. E.            | 2 to 3   | A. M. Moderate in the first part of the day                                                                              |
|               | 8 A. M. |                 |                  |                                       | E. by N.            | ...      | Towards night, a heavy swell from E.                                                                                     |
|               | Noon    | 15° 30'         | 91° 06'          | 29·820                                | NNE to E            | 3 to 5   | by N. Thick heavy rain most of the day.                                                                                  |
|               | 4 P. M. |                 |                  | ·750                                  | N. E.               | ...      | Overcast heavy sky all round, and dark gloomy weather.                                                                   |
|               | 8 P. M. |                 |                  | ·810                                  |                     |          | Bent storm sails at 2 P. M. and kept away south, as weather was looking very bad. Heavy swell from E. N. E. at midnight. |
|               | Midnt.  |                 |                  |                                       | N. by E to N. by W. | Squally. |                                                                                                                          |
| Byculla ....  | 4 A. M. |                 |                  | 29·880                                | N. E.               |          | 7 A. M. Moderate breeze and squally.                                                                                     |
|               | 8 A. M. |                 |                  | ·890                                  | E. N. E.            |          | 8 A. M. Overcast and squally with heavy rain.                                                                            |
|               | Noon    | 16° 00'         | 91° 10'          | ·840                                  | ...                 |          | Noon. Moderate breeze and overcast, with threatening appearance and rising sea.                                          |
|               | 4 P. M. |                 |                  | ·770                                  | ...                 |          | 4 P. M. Strong breeze and overcast, with frequent hard squalls.                                                          |
|               | 8 P. M. |                 |                  | ·770                                  | ...                 |          | 8 P. M. Strong freshening breeze, with hard squalls and rising sea.                                                      |
|               | Midnt.  |                 |                  | ·740                                  | ...                 |          | Midnight. Moderate gale and heavy squalls.                                                                               |

| Vessel.      | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.            |        | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------|---------|-----------------|------------------|---------------------------------------|-------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |         |                 |                  |                                       | Dir.              | Force. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Satara ..... | 4 A. M. |                 |                  | 29.800                                | N. E.             | 4      | 4 A. M. Moderate breeze and overcast sky, with passing squalls of wind. 8 A. M. Fresh breeze, sky cloudy and overcast. Squally appearance. Black bank of clouds rising to the East. 10 A. M. A gale of wind from N. E. 11 A. M. Wind moderating. Noon. Strong head wind and mountainous sea. Shipping large quantities of water, vessel pitching and rolling. 4 P. M. Strong breeze and heavy sea, with severe squalls of wind, and incessant rain. 8 P. M. to midnight. Same weather continued. |
|              | 8 A. M. |                 |                  | .850                                  | N. E.             | 5      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Noon    | 16° 35'         | 92° 09'          | .800                                  | E. N. E.          | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | 4 P. M. |                 |                  | .740                                  | E. N. E.          | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | 8 P. M. |                 |                  | .800                                  | E.                | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Midnt.  |                 |                  | .780                                  | E. by N.          | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Loanda ..... | Noon    | 16° 30'         | 92° 0'           |                                       | N. E.             | 4 to 5 | Weather overcast.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Bancoora ... | 4 A. M. |                 |                  | 29.902                                | E.                | 2      | Moderate wind and fine.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|              | 8 A. M. |                 |                  | .920                                  | N. E.             | 3      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Noon    | 17° 19'         | 85° 44'          | .887                                  | N. E.             | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | 4 P. M. |                 |                  | .838                                  | N. N. E.          | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | 8 P. M. |                 |                  | .867                                  | N. E. by N.       | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Midnt.  |                 |                  | .840                                  | N. N. E.          | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Chanda ..... | 4 A. M. |                 |                  | 29.830                                | N. E.             | 2      | Hazy.<br><br>Current N. 23° E.<br>0.5 mile per hour.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|              | 8 A. M. |                 |                  | .920                                  | N. N. E.          | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Noon    | 18° 56'         | 90° 30'          | .920                                  | N. N. E.          | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              |         |                 |                  |                                       | N. E. to S. E.    | 2      | At short intervals, heavy squalls from S. E.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|              | 4 P. M. |                 |                  | .750                                  |                   |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | 8 P. M. |                 |                  | .770                                  | Variable.         | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Midnt.  |                 |                  | .770                                  | S. E. to E. by S. | 5      | Heavy squalls from the eastward.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

| Vessel.      | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.   |        | REMARKS.                                            |
|--------------|---------|-----------------|------------------|---------------------------------------|----------|--------|-----------------------------------------------------|
|              |         |                 |                  |                                       | Dir.     | Force. |                                                     |
| Asia .....   | Noon    | 18° 53'         | 84° 39'          |                                       | N. E.    |        | Moderate wind, clear weather.                       |
| Mahratta ... | 4 A. M. |                 |                  | 29·860                                | N. N. E. | 4      |                                                     |
|              | 8 A. M. |                 |                  | ·920                                  | ...      | 4      |                                                     |
|              | Noon    | 21° 16'         | 90° 35'          | ·940                                  | ...      | 4      | Fine weather, smooth sea, and clear sky throughout. |
|              | 4 P. M. |                 |                  | ·800                                  | N.       | 3      |                                                     |
|              | 8 P. M. |                 |                  | ·870                                  | ...      | 3      |                                                     |
|              | Midnt.  |                 |                  | ·900                                  | ...      | 2      |                                                     |

The Satara, Byculla, Mount Stuart, and Scottish Hill were now in directions varying between N. N. W. and W. N. W. from the centre and at approximately the same distance, 250 miles. The Satara was in Lat. 16° 35' N. Long. 92° 9' E. by account at noon, and proceeding eastwards to Rangoon. Early in the morning, the weather was fine with moderate breezes. Occasional squalls of wind passed over the vessel. The weather became rapidly worse after 8 A. M. A heavy and dark bank of clouds appeared in the east, and at 10 A. M. a gale of wind blew from north-east. The sea rose very rapidly. During the afternoon and evening, the vessel experienced strong easterly winds with frequent heavy squalls, incessant rain, and a heavy sea. The Satara was not only approaching the centre, but was crossing its line of motion in front. Hence the very rapid change of weather which she experienced during the afternoon.

The Byculla was about 70 miles to the W. S. W. of the Satara at noon in Lat. 16° N. and Long. 91° 10' E. Her positions, as obtained by observation and dead reckoning, agree so closely as to show that there was no strong current in the northern and western quadrants of the cyclone, and hence that the position assigned to the Satara by account is probably approximately correct. The Byculla was advancing in almost the same track as the Satara, and gives a similar account of the weather. The morning began with moderate breezes and occasional squalls. The sky clouded over about 8 A. M., and heavy rain fell. The winds increased in force, and frequent hard squalls passed over the ship.

The Log of the ship Mount Stuart, which was in Lat.  $15^{\circ} 30'$  N. and Long.  $91^{\circ} 6'$  E. at noon, states that the sky was overcast, weather dark and gloomy, and so threatening at 2 P. M. that the Captain changed her course and kept away south. The Scottish Hill was 100 miles to the south-south-west in Lat.  $14^{\circ} 8'$  N. and Long.  $90^{\circ} 33'$  E. at noon. The sky was overcast, and frequent heavy rain squalls passed over the ship. A heavy swell from the north-east came up during the day. The weather over the north-east of the Bay is described in the logs of the Chanda, Bancoora, and Mahratta. The Bancoora, in Lat.  $17^{\circ} 19'$  N. and Long.  $85^{\circ} 44'$  E. at noon, had fine weather and moderate north-easterly winds of force varying from 2 to 4 during the day. The Chanda, in Lat.  $18^{\circ} 56'$  N. and Long.  $90^{\circ} 30'$  E. at noon, had fine weather with a hazy atmosphere, and light to moderate north-east winds. She was proceeding to Rangoon, and steaming directly towards the northern quadrant of the cyclone. Late in the evening, she began to experience squally weather and variable winds. Frequent heavy rain squalls came up from south-east and east after 8 P. M. The Mahratta proceeding from Chittagong to Calcutta, and the light vessels at the entrance to the Hooghly, had fine weather, clear skies, and a smooth sea throughout the whole day.

The meteorological data hence shew, conclusively that, during the 24 hours preceding 10 A. M. of the 11th, a definite cyclonic circulation of considerable intensity had been established to the west of the Andamans, the centre of which at noon of the 11th was probably in Lat.  $13^{\circ} 30'$  N. and Long.  $94^{\circ} 15'$  E. Heavy rain was falling over and near the centre, winds increased considerably in force during the day, the sea rose rapidly, and gave rise to a heavy swell extending to a distance of three or four hundred miles from the centre. The very rapid changes which had been initiated by the cyclonic motion are indicated very clearly by the weather experienced by the Satara.

12th November.—The barometric changes of the preceding 24 hours were irregular. This was in part due to the continuance of unsettled weather in Upper India. The depression which had formed on the 9th and 10th was filling up, and its existence was chiefly shewn on the morning of the 12th by cyclonic circulation of the air in Sind, and the adjacent districts of Rajputana. A smaller depression had, however, formed in the south-eastern districts of the Punjab, the centre of which was at or near Lahore. This was shewn by a slight fall of the barometer at Lahore and the neighbouring stations. The barometer had continued to rise rapidly over the greater part of the Punjab, Rajputana, and the Central Provinces, and over the whole of Central and Southern India. A rapid fall had occurred in Burmah, and a slight one in Bengal, due to the development and extension of the atmospheric whirl in the neighbourhood of the Andamans.

In Upper India, skies were more or less clouded in the area of the small depression, and rain fell during the day over nearly the whole of the Punjab, and the western districts of the North Western Provinces. In Bengal, the Central Provinces, Bombay, and Madras, skies were generally clear, weather fine, and winds light. Skies were overcast in Southern Burmah, and rain was generally falling.

Over the west coast of the Bay, pressure was remarkably uniform, the isobar of 29.95 being, in fact, almost identical with the coast line. The winds on the Coromandel coast were stronger than they were on the previous day, but were below their normal force. This is shown by the following statement :—

| Stations.    | Amount of wind<br>in miles per<br>hour since 10<br>A. M. previous<br>day. | Daily average<br>amount of wind<br>per hour. |
|--------------|---------------------------------------------------------------------------|----------------------------------------------|
| Vizagapatam  | 2                                                                         | 2.5                                          |
| Coconada ... | 6                                                                         | 9.0                                          |
| Masulipatam  | 2                                                                         | 6.0                                          |
| Madras ..... | 5                                                                         | 6.8                                          |
| Negapatam    | 5                                                                         | 5.6                                          |
| Salem .....  | 2                                                                         | 3.6                                          |
| Madura ..... | 4                                                                         | 4.1                                          |

The following are the observations taken at the stations affected by the cyclonic depression :—

| Stations.        | Barometer at 10<br>A. M. reduced to<br>sea level. | Changes since 10<br>A. M. previous<br>day. | Wind direction. |          | Velocity in miles<br>per hour since<br>10 A. M. previous<br>day. | Cloud amount at<br>10 A. M. | Rainfall at 10 A. M.<br>preceding<br>24<br>hours. | Weather.                    |
|------------------|---------------------------------------------------|--------------------------------------------|-----------------|----------|------------------------------------------------------------------|-----------------------------|---------------------------------------------------|-----------------------------|
|                  |                                                   |                                            | 10 A. M.        | 4 P. M.  |                                                                  |                             |                                                   |                             |
| Nancowry .....   | 29.884                                            | + .048                                     | S. W.           | S. W.    | 7                                                                | 7                           | 1.91                                              | Fine.                       |
| Port Blair ..... | 29.834                                            | + .074                                     | W. S. W.        | W. S. W. | 18                                                               | 8                           | 0.41                                              | Overcast                    |
| Diamond Island   | 29.659                                            | — .189                                     | E. S. E.        | S. S. E. | 25                                                               | 10                          | 4.58                                              | Severe<br>gale.             |
| Akyab .....      | 29.887                                            | ?                                          | N. N. E.        | E. N. E. | ?                                                                | 10                          | ...                                               | Fine.                       |
| Chittagong ...   | 29.899                                            | — .019                                     | Calm.           | N. N. W. | 1                                                                | 6                           | ...                                               | Fine.                       |
| Toungoo .....    | 29.885                                            | + .025                                     | N. W.           | N. W.    | ?                                                                | 10                          | ...                                               | Gloomy<br>weather.          |
| Bassein .....    | 29.762                                            | — .099                                     | E. N. E.        | E. S. E. | 12                                                               | 10                          | 5.97                                              | Overcast                    |
| Rangoon .....    | 29.870                                            | — .043                                     | E. N. E.        | S. E.    | 6                                                                | 10                          | 0.84                                              | Showery                     |
| Moulmein .....   | 29.869                                            | + .014                                     | S. E.           | S. E.    | 3                                                                | 6                           | 0.04                                              | Clouds<br>low with<br>sand. |
| Mergui .....     | 29.936                                            | + .052                                     | E. S. E.        | S. S. E. | 4                                                                | 10                          | 0.50                                              | Overcast                    |

The following information relating to the meteorology of the Bay for the 12th is taken from the logs of the vessels named:—

| Vessel.       | Hour.    | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.            |        | REMARKS.                                                                                                                                                 |
|---------------|----------|-----------------|------------------|---------------------------------------|-------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |          |                 |                  |                                       | Dir.              | Force. |                                                                                                                                                          |
| Mount Stuart  | 4 A. M.  |                 |                  | 29.700                                | N. N. W.          | 5      | .                                                                                                                                                        |
|               | Noon     | 14° 19'         | 91° 41'          | .750                                  | W. N. W.          | 5 to 6 | A number of small land birds at about sunset. The moon has had a large ring round it the last few nights.                                                |
|               | 4 P. M.  |                 |                  |                                       | N. W.             | 5      |                                                                                                                                                          |
|               | Midnt.   |                 |                  |                                       | N. W.             | 5      |                                                                                                                                                          |
| Scottish Hill | 4 A. M.  |                 |                  | 29.770                                | N. N. W.          | 5      | 4 A. M. Cloudy and rain squalls. Heavy sea from N.E.                                                                                                     |
|               | 8 A. M.  |                 |                  | .790                                  | N. N. W.          | 4      | 8 A. M. Heavy rain squalls, sky thick and gloomy, heavy sea from N. N. E. Noon.                                                                          |
|               | Noon     | 14° 36'         | 92° 17'          | .720                                  | N. W. to W. N. W. | 10     | Shift of wind to N. W. with heavy, fierce squalls. Sky one mass of heavy black clouds, and rain like a black wall to W.N.W.                              |
|               | 4 P. M.  |                 |                  | .630                                  | W. S. W.          | 10     | 2 P. M. Fierce squalls. Heavy bank of clouds to the N. W. and N.                                                                                         |
|               | 5 P. M.  |                 |                  | .660                                  | W. S. W.          |        | 5 P. M. Weather clearer, and squalls lighter. Heavy confused sea.                                                                                        |
|               | Midnt.   |                 |                  | .720                                  | SW by W           | 8      | Scud in dark masses from N. W. Midnight. Fresh squalls and heavy rain.                                                                                   |
|               |          |                 |                  |                                       |                   |        | .                                                                                                                                                        |
| Byculla ..... | 2 A. M.  |                 |                  | 29.730                                | E. N. E.          |        | A. M. Freshening gale with very heavy squalls, blinding rain, and high head sea.                                                                         |
|               | 4 A. M.  |                 |                  | .660                                  | ...               |        | Ship labouring heavily.                                                                                                                                  |
|               | 6 A. M.  |                 |                  | .570                                  |                   |        | 8 A. M. Strong gale with heavy squalls, and high N.E. sea.                                                                                               |
|               | 8 A. M.  |                 |                  | .480                                  | N. E.             |        | Shipping water fore and aft.                                                                                                                             |
|               | 10 A. M. |                 |                  | .480                                  | ...               |        | Noon. Wind and sea increasing. Heavy gale, with overcast sky, and continual heavy squalls. Ship labouring heavily, and shipping heavy seas fore and aft. |
|               | Noon     | 16° 03'         | 92° 36'          | .410                                  | NE. by N.         |        |                                                                                                                                                          |
|               | 2 P. M.  |                 |                  | .380                                  | N. N. E.          |        |                                                                                                                                                          |
|               | 4 P. M.  |                 |                  | .380                                  | N. by E.          |        |                                                                                                                                                          |
|               | 6 P. M.  |                 |                  | .370                                  | N. by W.          |        |                                                                                                                                                          |



| Vessel.                  | Hour.    | Latit<br>N      | Longit<br>E. | Winds.            |                                            | REMARKS.                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------|----------|-----------------|--------------|-------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |          |                 |              | Dir.              | Force.                                     |                                                                                                                                                                                                                                                                                                                                                                        |
| Byculla ....<br>(Contd.) | 8 P. M.  |                 | 29° 37'      | N. N. W           |                                            | 8 P. M. Heavy gale<br>with terrific squalls<br>from the North.<br>Midnight. Weather<br>moderating.                                                                                                                                                                                                                                                                     |
|                          | 10 P. M. |                 | 390          | N. W. to          |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | Midnt.   |                 | 400          | West.             |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
| Satara                   | 4 A. M.  |                 | 29° 71'      | NE. by E          |                                            | A. M. Strong gale from<br>N. E. with heavy sea,<br>accompanied with<br>heavy squalls of wind,<br>and incessant rain.<br>8 A. M. Hard gale,<br>violent squalls, heavy<br>rain, very thick wea-<br>ther. Noon. Wind<br>and sea continued<br>the same; heavy rain<br>squalls. 4 P. M. to<br>midnight. Strong<br>gale from E. by N.,<br>same wind and wea-<br>ther.        |
|                          |          |                 | 660          | N. E.             |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 8 A. M.  |                 | 650          |                   |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | Noon     | 16° 30' 03" 30' | 610          | E. by N.          |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 4 P. M.  |                 | 530          |                   |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 8 P. M.  |                 | 540          |                   |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | Midnt.   |                 | 520          | E. S. E.<br>S. E. |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
| Chanda ....              | 4 A. M.  |                 | 29° 71'      | E. to NE.         |                                            | Morning. Heavy squalls<br>from E. N. E. Sea ris-<br>ing fast; S. E. swell<br>increasing rapidly.<br>Noon. Strong gale<br>with high cross sea.<br>Weather having all<br>the appearance of a<br>cyclone.<br>Afternoon. Fierce gale<br>and high sea, with<br>hard squalls and<br>heavy rain. Barome-<br>ter falling slowly.<br>Evening. Terrific<br>squalls and high sea. |
|                          |          |                 |              | E. N. E. t        |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 8 A. M.  |                 | 730          | N. E.             |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | Noon     | 16° 31' 03" 09' | 640          | N. E.             |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 4 P. M.  |                 | 560          | N. E.             |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 8 P. M.  |                 | 610          | N. N. E.          |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 10 P. M. |                 | 490          |                   |                                            |                                                                                                                                                                                                                                                                                                                                                                        |
| Midnt.                   |          | 560             | N. N. W      |                   | Cleared up a little, less<br>rain and sea. |                                                                                                                                                                                                                                                                                                                                                                        |
| Bancoora                 | 4 A. M.  |                 | 29° 798      | N.                |                                            | 6 A. M. Squally ap-<br>pearance to north-<br>ward.<br>2 P. M. Fresh breeze<br>and squally with light<br>rain. Heavy sea from<br>E. and E. N. E.                                                                                                                                                                                                                        |
|                          | 8 A. M.  |                 | 849          | N.                | 5                                          |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | Noon     | 16° 40' 89" 11' | 805          | N.                | 5                                          |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 4 P. M.  |                 | ?            | N. N. W.          | 4                                          |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | 8 P. M.  |                 | 818          | N. W.             | 4                                          |                                                                                                                                                                                                                                                                                                                                                                        |
|                          | Midnt.   |                 | 849          | N. N. W.          | 4                                          |                                                                                                                                                                                                                                                                                                                                                                        |

| Vessel.      | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.   |          | REMARKS.                           |
|--------------|---------|-----------------|------------------|---------------------------------------|----------|----------|------------------------------------|
|              |         |                 |                  |                                       | Dir.     | Force.   |                                    |
| Loanda ..... | Noon    | 16° 45' ?       | 91° 46' ?        | 29·700                                | E. N. E. | 6+       | Heavy rain and sky overcast.       |
| Asia ... ..  | 4 A. M. |                 |                  |                                       | N. E.    | Moderate | Clear weather.                     |
|              | 8 A. M. |                 |                  |                                       | N. E.    | Fresh.   |                                    |
|              | Noon    | 17° 42'         | 87° 42'          |                                       | N. E.    | "        | Cloudy and confused swell.         |
|              | 4 P. M. |                 |                  |                                       | N. E.    | "        | Cloudy and heavy S.W. swell.       |
|              | 8 P. M. |                 |                  |                                       | N. E.    |          | Cloudy and heavy S.E. swell.       |
|              | Midut.  |                 |                  |                                       | N. E.    | Strong.  | Overcast and heavy easterly swell. |

The observations at the land observatories indicate that the depression was to the north of the Andamans on the morning of the 12th. The centre had thus moved in a north-north-west direction since noon of the 11th. The barometer had risen considerably at Port Blair and Nancowry, and on the east coast of the Martaban Gulf. Strong winds continued at Nancowry and Port Blair, more especially at the latter station. The sky was cloudy at Nancowry, and was still very dark and gloomy at Port Blair. Moderate rain had fallen during the preceding 24 hours at these stations.

A very considerable fall of the barometer had occurred in South West Burmah, more especially at Diamond Island and at Bassein. The winds were unusually strong at Diamond Island. The observer at that station reported a severe gale at 10 A. M. Very heavy rain was also falling in South Burmah. Diamond Island registered 4·58 inches at 10 A. M., and Bassein, 5·97 inches. On the Arakan coast, the weather at 10 A. M. was fine with passing clouds, and light N. N. E. winds.

The position of the centre can only be roughly approximated from the land observations. It was evidently to the W. S. W. of Diamond Island and at no great distance. The information extracted from the ships' logs enables us to determine it with approximate accuracy. An examination of the positions of the vessels, as determined by observation and dead reckoning on the 12th and 13th, indicates, that the positions assigned to all the vessels, except the Satara, at noon of the 12th, may be accepted as approximately true. There appears to have been very little current in the western and

northern quadrants of the cyclonic area. The only marked current at this time in the Bay was in the eastern quadrant of the storm area, where the winds were strongest. This current was continued northwards along the west coast of Burmah. The Satara, which was nearest the coast, experienced a very strong northerly current, which carried her 171 miles to the northward and westward (N. 13° W.) between noon of the 11th and noon of the 14th. Her probable position at noon of the 12th, so far as can be determined from the wind direction and height of her barometer, was in Lat. 16° 30' N. and Long. 93° 30' E.

The Byculla, Satara, Ioanda, and Chanda were all in the northern quadrant. The Byculla was nearest the centre, which apparently passed a short distance to the east of that steamer, late in the evening (about 8 P. M.) Early in the morning, she had a gale with very heavy squalls, blinding rain, and a high sea. The weather grew worse as she advanced southwards. At noon, she experienced a heavy gale with continual heavy squalls. The weather was at its worst about 8 P. M., when a heavy gale was blowing with terrific squalls. Her barometer (corrected) stood at that hour at 29·37, the lowest reading taken during the storm. The weather began to moderate at midnight, when she had westerly winds, and the storm was passing to the northward.

The Chanda also passed to the westward of the storm. She was at least 150 miles from the centre early in the morning of the 12th. At that time, heavy squalls from the E. N. E. passed over the vessel, and a swell came up from the south-east which increased rapidly. At noon, she had a fierce gale with hard squalls, and heavy rain. The barometer fell slowly, and the Captain at 4 P. M. judiciously changed the course of the vessel to the south-west, and thus kept clear of the storm centre. At 8 P. M., the squalls were terrific in force, and the sea very high. The barometer was at its lowest at 10 P. M., when the corrected reading was 29·49. The wind at that hour was hauling from N. N. E. to N. N. W. Shortly afterwards, the weather began to moderate.

The Satara was to the north of the centre during the day, and crossed from the western to the eastern quadrant. She, consequently, not only experienced the full force of the hurricane, but was carried a considerable distance to the northward by the current, and thus involved in it for a much longer time than either of the preceding vessels. Early in the morning, she had a strong gale from the N. E. with heavy squalls, incessant rain, and a high sea. She continued to experience similar weather during the day. The wind, which was from N. E. at 4 A. M., shifted to E. by N. at noon, and to S. E. at midnight. She was, judging from the unusually small rise of her barometer between 4 P. M. and 8 P. M., probably nearest to the centre between 8 P. M. and midnight. Her low-

est reading is not given, but when corrected, it probably slightly exceeded 29·5. She was about the same distance as the Chanda from the centre. The Mount Stuart and Scottish Hill were in the south-west quadrant, but at considerable distances from the centre. The former, which was in Lat. 14° 19' N. and Long. 91° 41' E. at noon, had winds of force 5 to 6 during the day. The Scottish Hill was nearer to the centre. During the morning, she had cloudy weather with rain squalls, and a heavy sea. Occasional shifts of wind occurred in heavy squalls, which passed over the vessel from the N. W. She was just on the margin of the storm area. The force of the wind varied from 4 to 5. The Captain describes the appearance of the cyclone area crossing to the N. W. in front of his ship as a mass of heavy black cloud and rain. During the remainder of the afternoon, fierce squalls passed over the vessel. The wind was of force 10, and hauled to W. S. W. at 4 p. m. The weather moderated a little afterwards, but she continued to have fresh squalls, heavy rain, and a high confused sea, during the remainder of the night.

The Asia was about 400 miles to the W. N. W. in Lat. 17° 42' and Long. 87° 42' E. at noon. She had fresh to strong N. E. winds during the day, and a heavy swell from the S. E. The Bancoora was 260 miles to the W. N. W. in Lat. 16° 40' N. and Long. 89° 11' E. She had northerly winds of force 5 until noon, and N. N. W. winds of force 4, during the remainder of the day. The weather had a squally appearance in the morning. As she advanced eastward, a heavy swell set in from the E. and E. N. E., which increased during the day. The logs of the Bhandara and of the light vessels near the mouth of the Hooghly show that light northerly winds were blowing at the Head of the Bay, and that the weather was fine, sky clear, and sea smooth.

A comparison of the position of the vessels at noon with respect to the storm indicates that the centre was approximately in Lat. 15° 30' N. and Long. 93° E. at noon.

On this supposition, the following were the distances and bearings of the vessels from the storm centre at noon :—

|                     | Bearing of<br>centre of<br>storm. | Distance of<br>centre of<br>storm. | Barometer<br>at noon. |
|---------------------|-----------------------------------|------------------------------------|-----------------------|
| Diamond Island      | E. N. E.                          | 90                                 | 29·64                 |
| Byculla .....       | N. N. W.                          | 45                                 | 29·41                 |
| Chanda .....        | N.                                | 75                                 | 29·64                 |
| Satara .....        | N. E.                             | 75                                 | 29·61                 |
| Scottish Hill ..... | S. W.                             | 85                                 | 29·72                 |
| Mount Stuart ...    | S. W.                             | 120                                | 29·75                 |
| Bancoora .....      | W. N. W.                          | 260                                | 29·81                 |
| Asia .....          | W. N. W.                          | 400                                | ?                     |

13th November.—The chief feature in the meteorology of India on the 13th was the cyclonic disturbance off the Burmese coast. A rapid rise of the barometer during the preceding 24 hours over the Punjab and Sind, completely obliterated the barometric depression in that area. Pressure was highest over the Indus valley, where it slightly exceeded 30·15". The barometer had also risen in the Central Provinces, Bombay, and Madras, but had decreased in Bengal and Arakan. Hence pressure diminished from west to east, and was lowest at Diamond Island, where it was 29·826".

The large depression off the Burmese coast was very distinctly marked. Winds were blowing a southerly gale in the Gulf of Martaban. They were easterly at Akyab, northerly in Bengal and on the Ganjam and Madras coasts, thus establishing general cyclonic circulation over the Bay. Elsewhere the winds were generally from the eastward, except in the Indus valley, where they were northerly.

The sky was dull and cloudy in the Punjab, and moderate rain had fallen during the previous 24 hours. The sky, however, rapidly cleared during the day, and was almost free of cloud by 4 P. M. Over the remainder of the Indian land area, excepting Burmah, the sky was clear and the weather fine. The following table gives the more important meteorological observations taken at the land stations :—

| Stations.        | Barometer at 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Wind direction. |          | Velocity in miles per hour since 10 A. M. previous day. | Cloud amount at 10 A. M. | Rainfall at 10 A. M. preceding 24 hours. | Weather.             |
|------------------|---------------------------------------------|-------------------------------------|-----------------|----------|---------------------------------------------------------|--------------------------|------------------------------------------|----------------------|
|                  |                                             |                                     | 10 A. M.        | 4 P. M.  |                                                         |                          |                                          |                      |
| Nancowry .....   | 29·940                                      | +·056                               | S. W.           | S. W.    | 3                                                       | 7                        | 0·83                                     | Fine.                |
| Port Blair ..... | 29·896                                      | +·062                               | W. S. W.        | W. S. W. | 10                                                      | 5                        | 0·15                                     | Fine.                |
| Diamond Island   | 29·826                                      | +·167                               | S.              | S.       | 29                                                      | 10                       | 1·47                                     | Severe gale.         |
| Akyab .....      | 29·863                                      | —·024                               | E. N. E.        | N. N. E. | 5                                                       | 10                       | 0·59                                     | Showery.             |
| Chittagong ...   | 29·855                                      | —·044                               | N.              | Calm.    | 1                                                       | 9                        | ...                                      | Sultry.              |
| Toungahoo .....  | 29·881                                      | —·004                               | N. W.           | N. W.    | ?                                                       | 10                       | 0·42                                     | Threatening weather. |
| Bassein .....    | 29·830                                      | +·068                               | E. S. E.        | S. S. E. | 18                                                      | 10                       | 5·90                                     | Overcast.            |
| Rangoon .....    | 29·887                                      | +·017                               | E. S. E.        | S. S. E. | 9                                                       | 8                        | 2·42                                     | Constant rain.       |
| Moulmein .....   | 29·902                                      | +·033                               | S. S. E.        | S. S. E. | 3                                                       | 3                        | 1·11                                     | Constant rain.       |
| Mergui .....     | 29·943                                      | +·007                               | S. E.           | Calm.    | 2                                                       | 5                        | 0·30                                     |                      |

The information extracted from the logs of vessels affected by cyclonic disturbance off the Burmese coast is given in the ensuing statement:—

| Vessel.       | Hour.            | Latitude<br>N. | Longitude<br>E. | Reduced<br>miles. | Winds.            |                | REMARKS.                                                                                  |
|---------------|------------------|----------------|-----------------|-------------------|-------------------|----------------|-------------------------------------------------------------------------------------------|
|               |                  |                |                 |                   | Dir.              | Force.         |                                                                                           |
| Shazada.....  | 8 A. M.          | 13° 14'        | 94° 00'         | 29° 836           | S. by E.          | Strong.        |                                                                                           |
|               | Noon             | 13° 51'        | 93° 57'         |                   |                   |                | Cloudy and overcast.                                                                      |
|               | 4 P. M.          |                |                 | 714               | S.                |                |                                                                                           |
| Mount Stuart  | 4 A. M.          |                |                 |                   | N. W.             |                | Sea heavy from N. E. by N. It was more northerly towards noon. 2 P. M. Showery.           |
|               | 8 A. M.          |                |                 | 29° 870           |                   |                | 4 P. M. Heavy detached clouds. 5 P. M. Dull heavy sky, with bright pink colour at sunset. |
|               | Noon             | 14° 47'        | 91° 20'         |                   | W. N. W.          | 5              |                                                                                           |
|               | 4 P. M.          |                |                 | 740               | ...               | 5 to 6         |                                                                                           |
|               | 8 P. M.<br>Midnt |                |                 | 800               | ...<br>ble. to W. | 5<br>5         |                                                                                           |
| Asia          | 4 A. M.          |                |                 |                   | N. E.             | Mod-<br>erate. | Cloudy, heavy easterly swell, and squally.                                                |
|               | 8 A. M.          |                |                 |                   | N.                | Fresh.         | Overcast and heavy N. E. swell.                                                           |
|               | Noon             | 15° 54'        | 90° 58'         |                   | ...               |                | Squally, overcast, heavy N. E. swell.                                                     |
|               | 4 P. M.          |                |                 |                   | N. W.             | Mod-<br>erate. | Overcast, N. E. swell going down.                                                         |
|               | 8 P. M.          |                |                 |                   | W.                |                | Moderate breeze and overcast. Swell gone down.                                            |
|               | Midnt.           |                |                 |                   | SW by W           | Steady.        | Moderate breeze and cloudy.                                                               |
| Loanda .. .   | Noon             | 6° 16'         | 92° 54'         | 29° 500           | N. E.             | 10             | Game increasing.                                                                          |
|               | Midnt.           |                |                 |                   |                   |                | A hurricane.                                                                              |
| Scottish Hill | 8 A. M.          |                |                 | 29° 750           |                   |                | Noon. Heavy rain squalls.                                                                 |
|               | Noon             | 5° 56'         | 92° 10'         | 720               | W. by S.          |                | 6 P. M. Scud flying fast from N. W.                                                       |
|               | 4 P. M.          |                |                 | 700               |                   |                | Severe squalls and heavy sea. 10 P. M.                                                    |
|               | 6 P. M.          |                |                 | 680               |                   |                | Weather clearer, sea lighter, squalls less violent.                                       |
|               | 8 P. M.          |                |                 |                   | W. by S.          | 10             |                                                                                           |
|               | Midnt.           |                |                 | 790               |                   |                |                                                                                           |

| Vessel.      | Hour.    | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.              |        | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------|----------|-----------------|------------------|---------------------------------------|---------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |          |                 |                  |                                       | Dir.                | Force. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Chanda ..... | 4 A. M.  |                 |                  | 29·610                                | NNW. to<br>W. N. W. |        | Wind and sea going down. At short intervals, terrific squalls attended by heavy rain. Strong wind and heavy rain squalls. Strong breeze and cloudy. Occasional heavy squalls.                                                                                                                                                                                                                                                                                                                                                                                        |
|              | 8 A. M.  | 16° 02'         | 93° 11'          | ·650                                  | WNW. to<br>S. W.    |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | Noon     |                 |                  | ·670                                  | S. S. W.            |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 4 P. M.  |                 |                  | ·690                                  | S. S. W.            |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 8 P. M.  |                 |                  | ·790                                  | S. E.               |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | Midnt.   |                 |                  | ·770                                  | SE. by S.           |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Byculla ..   | 2 A. M.  |                 |                  | 29·440                                | W.                  |        | Heavy gale with dark overcast sky. Wind veered to S. W., increased and blow with great violence in terrific squalls with rain. High confused sea.<br>8 A. M. Heavy gale with terrific squalls from S. W. to S. S. W. High confused sea. Shipping heavy water fore and aft. 11 A. M. Weather moderating, but sea very confused. Noon. Wind and sea moderating. Squalls less frequent and not so hard.<br>8 P. M. Strong breeze and overcast, with sharp squalls and heavy rain, high sea still running. Mid-night. Fresh breeze with passing squalls. Sea going down. |
|              | 4 A. M.  |                 |                  | ·450                                  | S. W.               |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 6 A. M.  |                 |                  | ·460                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 8 A. M.  |                 |                  | ·510                                  | S. S. W.            |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 10 A. M. |                 |                  | ·520                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | Noon     | 16° 10'         | 93° 11'          | ·560                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 2 P. M.  |                 |                  | ·580                                  | S. W.               |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 4 P. M.  |                 |                  | ·660                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 6 P. M.  |                 |                  | ·720                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 8 P. M.  |                 |                  | ·780                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 10 P. M. |                 |                  | ·810                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | Midnt.   |                 |                  | ·830                                  | ...                 |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Satara ..... | 4 A. M.  |                 |                  | 29·520                                | S. E.               | 8      | 4 A. M. Fresh gale, violent squalls of wind and rain, heavy head sea. 8 A. M. Strong gale, violent squalls, heavy rain. 10-45 A. M. Wind shifted to S. by E. Noon. Strong gale                                                                                                                                                                                                                                                                                                                                                                                       |
|              | 8 A. M.  |                 |                  | ·630                                  | ...                 | 9      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | Noon     | 16° 20'         | 93° 30'          | ·680                                  | S. E.               | 9      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | 4 P. M.  |                 |                  | ·670                                  | S. E.               | 8      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Vessel.      | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.            |        | Remarks.                                                                                                                                                                                                                                                |
|--------------|---------|-----------------|------------------|---------------------------------------|-------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              |         |                 |                  |                                       | Dir.              | Force. |                                                                                                                                                                                                                                                         |
| Satara ..... | 8 P. M. |                 |                  | 730                                   | ...               | 8      | from S. E. Violent squalls of wind and rain. 4 P. M. Fresh gale, violent squalls of wind and rain. Sea moderating. Water had a greenish tint. 6-30 P. M. Fresh gale, thick weather, with violent squalls.                                               |
| (Contd.)     | Midnt.  |                 |                  | 750                                   | S by W to S. E.   | 8      |                                                                                                                                                                                                                                                         |
| Bancoora ..  | 4 A. M. |                 |                  | 29.828                                | N. W.             | 7      | 6-15 A. M. Tremendous heavy sea from N. E. 10 A. M. Lulls and very heavy squalls and rain. 7 P. M. Clearing somewhat, wind and sea moderating, vessel at times rolling fearfully.                                                                       |
|              | 8 A. M. |                 |                  |                                       | W. N. W.          | 7      |                                                                                                                                                                                                                                                         |
|              | Noon    | 16° 31'         | 91° 55'          | 770                                   | W. N. W.          | 6      |                                                                                                                                                                                                                                                         |
|              | 4 P. M. |                 |                  |                                       | West              | 7      |                                                                                                                                                                                                                                                         |
|              | 8 P. M. |                 |                  |                                       | W. S. W.          | 4      |                                                                                                                                                                                                                                                         |
|              | Midnt.  |                 |                  | 30.049                                | W.                | 3      |                                                                                                                                                                                                                                                         |
| Mahratta     | Noon    | 22° 00'         | 91° 44'          | 29.910                                | S. W. to S. E.    | 1      | 4 P. M. Slight swell from S. E. To eastwards, dense heavy clouds; to westwards, sky clear near the horizon; to northwards, light fleecy looking clouds, apparently motionless. Midnight. Sky completely overcast, with occasional rain and heavy swell. |
|              | 4 P. M. |                 |                  | 760                                   | E.                | 2      |                                                                                                                                                                                                                                                         |
|              | 8 P. M. |                 |                  | 780                                   | N. E.             | 3      |                                                                                                                                                                                                                                                         |
|              | Midnt.  |                 |                  | 780                                   | E. N. E. to N. E. | 5      |                                                                                                                                                                                                                                                         |

The observations taken at the land stations show that the barometer had risen rapidly at Diamond Island, moderately at Bassein, Port Blair, and Nancowry, and very slightly at Mergui and Rangoon. It was falling slowly at Akyab and Chittagong, in front of the storm area.



Winds were much lighter at Nancowry and Port Blair, but were unaltered in direction, and continued to give moderate rain. They had veered to S. S. E. in Burmah, except at Diamond Island, where they were from the south. A severe gale of wind had prevailed at that station during the previous 24 hours, but was beginning to moderate. Heavy rain had been brought up by the southerly winds into South Burmah. Bassein received 5·9 inches, Rangoon 2·4, and Diamond Island 1·47 during the previous 24 hours.

The land observations are not sufficient to enable the position of the centre of the storm at this time to be inferred. The slight shift of wind at Diamond Island, the considerable rise of the barometer at that station, and the very small fall at Akyab, indicate that the storm was being largely influenced and retarded by the action of the Burmese and Arakan hills. The southerly winds in the easterly quadrant, instead of passing mainly over a water surface, were now blowing partly over South Burmah. The friction between the winds and the earth's surface, and the action of the hills in breaking up and disintegrating the rotatory or vorticose motion of the air, evidently account for the change which was taking place, and which is more clearly shown by the ships' observations.

The *Satara* was in the north-east quadrant. Her position at noon was probably about Lat.  $16^{\circ} 20'$  N. and Long.  $94^{\circ}$  E. She was between the storm centre and the Burmese coast, and received the full weight of the southerly winds during the day. She had strong gales with violent squalls and heavy rain during the whole day, and the weather only began to moderate about 8 P. M., after which she had a fresh gale with thick weather and heavy squalls.

The position of the *Loanda* is slightly doubtful. She was almost in front of the cyclonic centre, probably a few miles only to the west. She had north-easterly winds of force 10 at midday. The storm increased, and at midnight was blowing a hurricane. Her barometer at midday (corrected) was 29·5.

The *Byculla* was in the south-east quadrant. She had crossed the path of the centre on the previous evening at about 11 P. M., and steamed away to the east during the day. Early in the morning, she was near the centre, and received the full weight of the south-westerly winds. The wind veered to south-west shortly after midnight, and blew with great violence; terrific squalls of wind and rain passing over the ship at intervals. At 8 A. M., the wind blew a heavy gale with terrific squalls from S. S. W. and S. W., bringing up a high confused sea. Weather began to moderate after 11 A. M., and in the afternoon, when the vessel was probably 200 miles away from the storm centre, she experienced fresh breezes with passing squalls. The barometer rose rapidly and continuously during the day from 29·44 at 2 A. M. to 29·83 at midnight.

The Chanda and Bancoora were passing early in the morning through the south-west and south quadrants of the depression. The Chanda experienced terrific squalls with heavy rain. The winds commenced at W. N. W., and hauled round to S. W. at 8 A. M. As she advanced south-eastwards during the afternoon, the weather improved, and wind shifted round to S. E., when strong breezes with occasional squalls and cloudy weather prevailed.

The Bancoora was further to the westward, and hence did not encounter such strong winds as the Chanda. During the day, the winds gradually shifted from north-west to west, and were of average strength 7. Very heavy squalls of wind and rain passed over the vessel, and a tremendous heavy sea came up from north-east early in the morning. As the storm centre passed to the northwards, and the vessel proceeded eastwards, the wind and sea moderated.

The remaining vessels were at greater distances away. The Scottish Hill to the W. S. W. of the centre (in Lat.  $15^{\circ} 56'$  N. and Long.  $92^{\circ} 10'$  E.) had very heavy rain squalls (force 9 to 10) during the day. The weather began to clear at about 10 P. M.

The Asia, in Lat.  $15^{\circ} 54'$  N. and Long.  $90^{\circ} 58'$  E. at noon, was proceeding south-eastward to Port Blair, and passed through the outer part of the south-westerly quadrant. She had squally overcast weather with a heavy N. E. swell during the day. At midnight, she had steady, moderate S. W. breezes with cloudy weather. The Mount Stuart was in the west and south-west quadrants, and experienced moderate winds of force 5, with occasional squalls.

The Mahratta, between Chittagong and Akyab, had light variable winds, and fine weather, during the early part of the day. The sky clouded over and was overcast at night, when rain began to fall, and a heavy swell to come up. The Bhundara, off Gopaulpore, had light airs or calms, and a clear sky.

Assuming the position for the storm centre at noon to have been in Lat.  $16^{\circ} 10'$  N. and Long.  $93^{\circ}$  E., the following table gives its position with respect to the vessels near it:—

| Names of Vessels.   | Position.        |                  | Direction of storm centre from vessel. | Distance of storm centre from vessel. | Barometer at Noon. |
|---------------------|------------------|------------------|----------------------------------------|---------------------------------------|--------------------|
|                     | Longitude. N.    | Latitude. E.     |                                        |                                       |                    |
| Loanda .....        | $16^{\circ} 16'$ | $92^{\circ} 54'$ | N. N. W.                               | 9                                     | 29.50 ?            |
| Chanda .....        | $16^{\circ} 02'$ | $93^{\circ} 11'$ | E.                                     | 15                                    | 29.69 ?            |
| Byculla .....       | $16^{\circ} 10'$ | $93^{\circ} 11'$ | E.                                     | 12                                    | 29.56              |
| Satara .....        | $16^{\circ} 20'$ | $93^{\circ} 30'$ | E. N. E.                               | 35                                    | 29.68              |
| Scottish Hill ..... | $15^{\circ} 56'$ | $92^{\circ} 10'$ | W.                                     | 56                                    | 29.72              |
| Bancoora .....      | $16^{\circ} 31'$ | $91^{\circ} 55'$ | W.                                     | 74                                    | 29.77              |
| Mount Stuart .....  | $14^{\circ} 47'$ | $91^{\circ} 20'$ | S. S. W.                               | 140                                   | 29.85              |
| Asia .....          | $15^{\circ} 54'$ | $90^{\circ} 58'$ | W.                                     | 130                                   | 29.85              |
| Mahratta .....      | $21^{\circ} 59'$ | $91^{\circ} 44'$ | N. N. W.                               | 400                                   | 29.91              |
| Bhundara .....      | Off Gopaulpore.  |                  | W.                                     | ...                                   | 29.89              |

14th November.—The only feature of importance in the meteorology of India was the depression off the Arakan and Burmese coasts. Pressure was again giving way quickly over the Punjab, and to a less extent in all other parts of the country, except at a few stations in Bombay, South Madras, and in Arakan. The highest pressure (30·1) was over Sind, and the lowest (29·69) in Arakan at Akyab. Gradients were not steep, except in and near the cyclonic disturbance. The storm centre in the Bay was approaching Akyab at 10 A. M. The weather was overcast with heavy rain in Burmah and Arakan. A considerable increase of cloud had taken place in Lower Bengal. The sky had cleared in the Punjab and North-west Himalaya, and weather was fine over the whole of India, except in the immediate neighbourhood of the cyclonic disturbance. The winds were more northerly than usual in Northern India. In Bengal and on the Madras coast, winds were blowing chiefly from the north west. They were, however, as during the previous week, light in the neighbourhood of the Madras coast.

The following tables give the observations relating to the weather of the 14th taken at the land stations in the neighbourhood of the cyclonic disturbance, and the meteorological information extracted from the logs of vessels :—

| Stations.        | Barometer at 10 A. M. reduced to sea level.<br>Change since 10 A. M. previous day. |       | Wind direction. |          | Velocity in miles per hour since 10 A. M. previous day. | Cloud amount at 10 A. M. | Rainfall at 10 A. M. preceding 24 hours. | Weather.   |
|------------------|------------------------------------------------------------------------------------|-------|-----------------|----------|---------------------------------------------------------|--------------------------|------------------------------------------|------------|
|                  |                                                                                    |       | 10 A. M.        | 4 P. M.  |                                                         |                          |                                          |            |
| Nancowry .....   | 29·921                                                                             | —·019 | S. W.           | S. W.    | 2                                                       | 8                        | 0·63                                     | Cloudy.    |
| Port Blair ..... | 29·924                                                                             | +·028 | W. N. W.        | S. S. E. | 6                                                       | 6                        | 0·61                                     | Cloudy.    |
| Diamond Island   | 29·898                                                                             | +·072 | S.              | S.       | 17                                                      | 7                        | 0·64                                     |            |
| Akyab .....      | 29·692                                                                             | —·171 | N.              | W.       | 8                                                       | 10                       | 2·44                                     | Raining.   |
| Chittagong ...   | 29·772                                                                             | —·083 | N. W.           | W.       | 1                                                       | 8                        | ...                                      | Gloomy.    |
| Toungoo .....    | 29·866                                                                             | —·015 | N. W.           | S. W.    | ?                                                       | 10                       | 0·15                                     | Showery.   |
| Bassein .....    | 29·922                                                                             | +·092 | W. S. W.        | S.       | 14                                                      | 10                       | 1·42                                     | Overcast.  |
| Rangoon .....    | 29·921                                                                             | +·034 | S.              | S. S. W. | 8                                                       | 10                       | 0·83                                     | Drizzling. |
| Moulmein .....   | 29·913                                                                             | +·011 | S. E.           | W.       | 4                                                       | 1                        | 0·33                                     | Fine.      |
| Mergui .....     | 29·948                                                                             | +·005 | N. E.           | N.       | 1                                                       | 8                        | 1·55                                     | Cloudy.    |

| Vessel.       | Hour.                                                                                        | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter.                          | Winds.                                                                   |                                | REMARKS.                                                                                                                                                                                                                                                                                                                                                                       |
|---------------|----------------------------------------------------------------------------------------------|-----------------|------------------|----------------------------------------------------------------|--------------------------------------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |                                                                                              |                 |                  |                                                                | Dir.                                                                     | Force.                         |                                                                                                                                                                                                                                                                                                                                                                                |
| Asia .....    | 4 A. M.<br>8 A. M.<br>Noon<br>4 P. M.                                                        | 13° 26'         | 93° 27'          |                                                                | S W by S.<br>S. S. W.<br>...<br>S.                                       | Mode-<br>rate.<br>...<br>Light | Moderate breeze and<br>fine weather during<br>the day.<br>Light breeze.                                                                                                                                                                                                                                                                                                        |
| Shazada.....  | 8 A. M.<br>Noon.<br>4 P. M.                                                                  | 14° 05'         | 90° 50'          | 29·841<br>758                                                  | W. N. W.<br>N. N. W.                                                     | Mode-<br>rate.<br>Light        |                                                                                                                                                                                                                                                                                                                                                                                |
| Chanda .....  | 4 A. M.<br>8 A. M.                                                                           | 15° 27'         | 95° 15'          | 29·860<br>860                                                  | S. S. W.<br>S. S. W.                                                     | 5<br>3                         | Clear weather.                                                                                                                                                                                                                                                                                                                                                                 |
| Bancoora ...  | 4 A. M.<br>8 A. M.<br>Noon<br>4 P. M.<br>8 P. M.<br>Midnt.                                   | 15° 51'         | 93° 50'          | 29·927<br>...<br>899<br>812<br>907<br>897                      | W. S. W.<br>W. S. W.<br>S. E.<br>S.<br>E. S. E.<br>S. E.                 | 3<br>3<br>3<br>2<br>2          | 4 A. M. Heavy norther-<br>ly sea. Ship rolling<br>heavily. 6 A. M. Mo-<br>derate breeze, heavy<br>confused sea, ship<br>rolling violently.<br>Noon. Pleasant breeze<br>and cloudy.                                                                                                                                                                                             |
| Mount Stuart  | 4 A. M.<br>Noon<br>4 P. M.<br>8 P. M.<br>Midnt.                                              | 15° 51'         | 91° 30'          | 29·890                                                         | Vtries to<br>W.<br>...<br>N. W.<br>...<br>N. N. W.                       | 5<br>5<br>3<br>2<br>1 to 2     | Heavy cross N. N. W. to<br>N. N. E. sea which gra-<br>dually abated. A flash<br>of lightning ahead<br>at 3 A. M. Passing<br>clouds, weather gradu-<br>ally getting finer look-<br>ing. Passed through<br>lots of bamboo roots<br>to-day. Fine moon-<br>light night.                                                                                                            |
| Byculla ..... | 2 A. M.<br>4 A. M.<br>6 A. M.<br>8 A. M.<br>10 A. M.<br>Noon<br>4 P. M.<br>8 P. M.<br>Midnt. | 15° 58'         | 93° 58'          | 29·780<br>760<br>820<br>860<br>890<br>890<br>880<br>920<br>950 | S. W.<br>...<br>...<br>S.<br>...<br>...<br>S. W.<br>S. S. W.<br>S. S. E. |                                | 2 A. M. Fresh breeze<br>and cloudy.<br>4 A. M. Moderate breeze<br>and cloudy, with pass-<br>ing squalls. 7 A. M.<br>Water very much dis-<br>coloured, muddy ap-<br>pearance, bottom 28<br>fathoms. Moderate<br>breeze and cloudy,<br>light passing squalls.<br>0-40 P. M. Sighted<br>Alguada Light House<br>to S. E. 1-30 P. M.<br>Light breeze and fine<br>with smooth water. |

| Vessel.       | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.   |        | REMARKS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------|---------|-----------------|------------------|---------------------------------------|----------|--------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               |         |                 |                  |                                       | Dir.     | Force. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Satara .....  | 4 A. M. |                 |                  | 29.730                                | S. S. E. | 7      | Moderate gale accom-<br>panied with heavy<br>squalls of wind and<br>rain. 4 A. M. Strong<br>breeze with heavy<br>squalls. 5 A. M. Very<br>dirty weather, wind<br>moderating, very<br>heavy squalls, and<br>sharp rain. 6-30 A. M.<br>Sighted land. 8 A. M.<br>Strong breeze and<br>thick dirty weather.<br>10 A. M. Fresh breeze,<br>weather clearing up<br>generally, occasional<br>heavy squalls. Noon.<br>Light breeze and fine.<br>Sea smooth. 4 P. M.<br>Light breeze and fine,<br>8 P. M. Sighted Al-<br>quada Reef Light.<br>Moderate breeze and<br>fine. Sea smooth.<br>Midnight. Light<br>breeze and fine. |
|               | 8 A. M. |                 |                  | 850                                   | S. S. W. | 6      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | Noon    | 16° 45'         | 94° 3'           | 880                                   | ...      | 2      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | 4 P. M. |                 |                  | 730                                   | ...      | 2      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | 8 P. M. |                 |                  | 900                                   | ...      | 4      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | Midnt.  |                 |                  | 900                                   | S. W.    | 2      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Scottish Hill | 4 A. M. |                 |                  | 29.820                                | W.       |        | Sky clearing. Sea<br>lighter, though much<br>confused. Heavy sea<br>from N. N. W. and<br>N. Weather fine,<br>but heavy bank of<br>clouds to N. N. W.<br>and N. N. E. Sea<br>going down fast.<br>Clouds clearing off.                                                                                                                                                                                                                                                                                                                                                                                                |
|               | 8 A. M. |                 |                  | 870                                   | ...      |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | Noon    | 17° 00'         | 92° 25'          | 880                                   | ...      |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | 8 P. M. |                 |                  |                                       | W. N. W. |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | Midnt.  |                 |                  | 890                                   | N. W.    |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Loanda .....  | 4 A. M. |                 |                  |                                       |          |        | Wind hauled round<br>through N.<br>Weather overcast with<br>light rain.<br>Weather improving.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|               | Noon    | 17° 34'         | 92° 46'          |                                       | W.       | 7 to 8 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|               | Midnt.  |                 |                  |                                       |          |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Mahratta ...  | 4 A. M. |                 |                  | 29.590                                | N. N. E. | 9      | Thick continual rain,<br>with heavy sea                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|               | 8 A. M. | Entered Akya-   |                  | 740                                   | N. N. W. | 8      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

\* A current set the ship from noon of 11th instant to noon of 14th instant N. 13° W. 171 miles.

The barometer had risen at Diamond Island and all the stations to the south and east, except Nancowry, where a slight fall was observed.

The rise was nowhere large, and was less than a tenth of an inch at all stations in that part of the Bay. A considerable ( $\cdot 17''$ ) fall had occurred at Akyab, and smaller changes of the same character at Chittagong and Toungoo. Judging from the barometric movements, the centre at 10 A. M. was in the immediate neighbourhood of Akyab.

The wind observations, however, are anomalous and almost unintelligible on the supposition of a well defined cyclonic circulation. The winds at Nancowry were steady from south-west, but were very feeble. At Port Blair, the wind was very unsteady, shifting from W. N. W. at 10 A. M. to S. S. E. at 4 P. M. Moderately strong S. W. winds continued at Diamond Island. The winds at 10 A. M. at Akyab were from N. and at Chittagong and Toungoo from N. W. They shifted at 4 P. M. to west at Akyab and Chittagong, and to S. W. at Toungoo. They were, however, very feeble at all these stations. The wind velocity averaged 8 miles per hour at Akyab, and only 1 mile per hour at Chittagong, where the air motion was actually less than the average in November, which is 2 miles per hour. The only inference from these observations is, that the cyclonic or vorticoise motion had been broken up to a large extent by the action of the hills and the friction of the land, and that it was no longer a well-defined cyclonic circulation. This is also indicated by the character of the rainfall at the land stations. It was more widely distributed than before, and was smaller in amount, the largest quantity registered being 2.44 inches at Akyab.

The vessels which have contributed logs were all on the southern and western quadrants at some distance from the centre. They give information which is less valuable and conclusive than that of the preceding days. The whole of the meteorological observations, when charted, indicate that the centre of the barometric depression at 10 A. M. was to the east of Akyab in Lat.  $20^{\circ}$  N. and Long.  $93\frac{1}{2}^{\circ}$  E., and that the cyclonic circulation was very irregular and fast breaking up. The *Mahratta*, from Chittagong, entered Akyab harbour at 8 A. M. She had thick continued rain during the night with northerly winds of force 9. The *Scottish Hill*, in Lat.  $17^{\circ}$  N. Long.  $92^{\circ} 25'$  E., was to the south of the centre at noon. She had winds from west to north-west. During the day, the sky cleared, and the sea went down. At noon, weather was fine, although a heavy bank of clouds was still to be seen to the N. N. W. and N. N. E., but it cleared off during the night.

The *Loanda*, in Lat.  $17^{\circ} 34'$  N. and Long.  $92^{\circ} 46'$  E. by account, had westerly winds, and overcast skies with slight rain.

The *Satara* found herself at noon in Lat.  $16^{\circ} 45'$  N. and Long.  $94^{\circ} 3'$  E. She experienced moderate winds of force 7 from S. S. E. early in the morning, and continued to have sharp squalls and heavy rain until

6 A. M., after which the weather rapidly improved. A fresh breeze was blowing at 10 A. M. with occasional heavy squalls. At noon, the storm was completely over, and she had light breezes of force 2 from the S. S. W., fine weather, and a smooth sea.

The Mount Stuart, in Lat.  $15^{\circ} 51'$  N. Long.  $91^{\circ} 30'$  E. at noon, had westerly winds of force 5 early in the morning, with a heavy cross sea. The weather improved rapidly, and was quite settled in appearance at night, with fine clear skies and light winds of force 1 to 2. The Byculla, Bancoora, and Chardda were steaming along the south coast of Burmah towards Rangoon. They had fine weather with south-westerly winds of average force 3.

It thus appears that the first action of the Burmese hills, which are comparatively low, had been to retard the advance of the centre very considerably between noon of the 12th and of the 13th. During the next 24 hours, it advanced rapidly almost due northwards with a very slight easterly tendency. It then approached the coast to the east of Akyab on the morning of the 14th. The depression was, however, very much smaller than hitherto, and the cyclonic motion very considerably broken up. The winds were irregular in direction near the centre. The rainfall was evidently much less in amount, and more widely distributed. The observations taken at Akyab and Chittagong at 4 P. M. shew that the disturbance was then almost completely disintegrated. There was at that hour an irregular, but very feeble, cyclonic circulation, which passed away before the following morning.

*15th November.*—The meteorology of the 15th is given to show how completely the cyclonic disturbance had broken up.

The barometric changes of the previous 24 hours were exceedingly irregular. The only important change was in Arakan, where the barometer had risen very rapidly with the disappearance of the cyclonic disturbance. The winds show very little alteration generally. In the North-West Provinces and Punjab, they were very variable. In Bengal and Orissa, they had a much stronger northerly component than is usual in November. The weather was fine, and skies were clear over nearly the whole country, except Burmah and Arakan, where they were still more or less clouded, and moderate rain was falling. In the Punjab, though the sky was generally clear and humidity decreasing, the weather still appeared unsettled. The exceptional character of the weather in the Punjab during the previous week, is illustrated by the fact that the average rainfall of the hill stations at Simla and Chakrata for the month of November is *nil*, whilst, during the previous fifteen days, four inches had fallen at the former station, and  $3\frac{1}{2}$  inches at the latter.

The following tables give the observations of the same stations as hitherto, and the meteorological information from the logs of several vessels in the Bay for the 15th November:—

| Stations.       | Barometer at 10 A. M. reduced to sea level. | Change since 10 A. M. previous day. | Winds.   |          | Velocity in miles per hour since 10 A. M. previous day. | Cloud amount at 10 A. M. | Rainfall at 10 A. M. preceding 24 hours. | Weather.   |
|-----------------|---------------------------------------------|-------------------------------------|----------|----------|---------------------------------------------------------|--------------------------|------------------------------------------|------------|
|                 |                                             |                                     | 10 A. M. | 4 P. M.  |                                                         |                          |                                          |            |
| Nancowry .....  | 29.889                                      | — .032                              | E.       | S.       | 2                                                       | 8                        | 1.47                                     | Cloudy.    |
| Port Blair ...  | 29.932                                      | + .008                              | N. N. E. | E. S. E. | 5                                                       | 3                        | 0.13                                     | Fine.      |
| Diamond Island  | 29.937                                      | + .039                              | E. S. E. | E. S. E. | 7                                                       | 6                        | 0.16                                     | Fine.      |
| Akyab .....     | 29.937                                      | + .215                              | E.       | S. S. E. | 5                                                       | 9                        | 0.33                                     | Gloomy.    |
| Chittagong ...  | 29.925                                      | + .153                              | S. S. E. | S. S. W. | 2                                                       | 6                        |                                          | Gloomy.    |
| Toungahoo ..... | 29.913                                      | + .047                              | N. W.    | N. W.    | ?                                                       | 6                        | 0.04                                     | Drizzling. |
| Bassein .....   | 29.952                                      | + .030                              | S. S. E. | W.       | 3                                                       | 10                       | 0.04                                     | Cloudy.    |
| Rangoon .....   | 29.952                                      | + .031                              | S. E.    | S. S. E. | 5                                                       | 9                        | 0.74                                     | Cloudy.    |
| Moulmein .....  | 29.899                                      | — .014                              | N.       | N. E.    | 2                                                       | 0                        |                                          | Fine.      |
| Mergui .....    | 29.920                                      | — .028                              | Calm.    | N.       | 1                                                       | 10                       | 1.50                                     | Overcast.  |

| Vessel.      | Hour.   | Latitude.<br>N. | Longitude.<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.   |        | REMARKS.                                           |
|--------------|---------|-----------------|------------------|---------------------------------------|----------|--------|----------------------------------------------------|
|              |         |                 |                  |                                       | Dir.     | Force. |                                                    |
| Shazada..... | 4 A. M. |                 |                  | 29.911                                | N. N. E. | Light. | Weather fine with light winds.                     |
|              | 8 A. M. |                 |                  |                                       |          |        |                                                    |
|              | Noon    | 12° 47'         | 87° 14'          |                                       |          |        |                                                    |
|              | 4 P. M. |                 |                  | .781                                  | N. N. E. | Light. |                                                    |
| Satara ..... | 8 P. M. |                 |                  |                                       |          |        |                                                    |
|              | 4 A. M. |                 |                  | 29.870                                | S. E.    | 2      | Light breeze and fine clear weather.               |
|              | 8 A. M. |                 |                  | .940                                  | ...      | 4      | Moderate breeze and fine weather.                  |
|              | Noon    | 15° 50'         | 95° 50'          | .980                                  | ...      | 4      | Current during the previous 24 hours, W. 65 miles. |
|              | 4 P. M. |                 |                  | .810                                  | N. E.    | 2      | Light breeze and fine weather.                     |



| Vessel.       | Hour.   | Latitude<br>N. | Longitude<br>E. | Probable re-<br>duced baro-<br>meter. | Winds.            |        | REMARKS.                                       |
|---------------|---------|----------------|-----------------|---------------------------------------|-------------------|--------|------------------------------------------------|
|               |         |                |                 |                                       | Dir.              | Force. |                                                |
| Asia          | 4 A. M. |                |                 |                                       | Variable          | Light  | Light and variable airs,<br>fine weather.      |
|               | Noon    | Port Blair.    |                 |                                       | ...               | ...    |                                                |
|               | 4 P. M. |                |                 |                                       | E. N. E.          | Light  | Light breeze and fine<br>clear weather.        |
|               | 8 P. M. |                |                 |                                       | ...               | Fresh  |                                                |
| Mount Stuart  | 4 A. M. |                |                 |                                       | N. N. W.          | 1      | 1 P. M. Smooth with<br>light N. swell. 4 P. M. |
|               | 8 A. M. |                |                 |                                       | N. by E.          | 1 to 2 | Heavy clouds all<br>round the horizon.         |
|               | Noon    | 16° 24' 02"    | 00° 29' 00"     |                                       | N. N. E.          |        | 5 P. M. Weather set-<br>tled looking.          |
|               | 4 P. M. |                |                 |                                       | NE by N           |        |                                                |
|               | Midnt.  |                |                 |                                       | NNE to<br>NE by N |        | Midnight. Clear fine<br>weather.               |
| Scottish Hill | 8 A. M. |                |                 |                                       | N. W.             |        | Light winds and swell<br>from N. N. W.         |
|               | Noon    | 18° 03' 02"    | 48' 20' 00"     |                                       |                   |        |                                                |
|               | 8 P. M. |                |                 |                                       | NNW to<br>N.      |        | Light winds and clear<br>sky.                  |
| Loanda .....  | Noon    | 18° 38' 02"    | 30' 20' 00"     |                                       | W by N.           |        |                                                |

The observations call for little remark. The rapid recovery of pressure at Akyah, and the lightness and irregularity of the winds in Arakan and Burmah, indicate the complete disappearance of the cyclonic vortex. The land observations show that the winds were very unsteady during the day. For instance, at Nancowry, they were from east at 10 A. M. and south at 4 P. M. Similarly, at Port Blair, they shifted from N. N. E. at 10 A. M. to S. S. E. at 4 P. M. It is probable that these were light local winds, for the logs of the vessels prove that, over the greater part of the Bay, north-easterly winds were again established. The Clan Macpherson, at the entrance to the Bay, in Lat. 6° N., had moderate north-easterly winds.

Hence the cyclonic circulation had not only broken up, but the south-westerly winds which had, as shown by the Nancowry registers, prevailed steadily up to the afternoon of the 14th, although they had decreased in strength considerably during the 12th, 13th, and 14th, had given way so

rapidly and entirely on the afternoon of the 14th, that light north-easterly winds were again established over nearly the whole of the Bay on the morning of the 15th. This speedy restoration of the normal circulation of the air after the disappearance of the disturbance, is perhaps less remarkable than it might seem to be, but is nevertheless noteworthy.

#### CHAPTER IV.

##### DISCUSSION OF THE CHIEF FEATURES OF THE STORM OF NOVEMBER 10TH TO 15TH.

The following gives a brief connected narrative of the more important features of the storm.

After the termination of the south-west monsoon in Bengal in the last week of September 1883, the winds shifted round to north over the Head of the Bay, and the lower air current of the south-west monsoon recurved over the middle of the Bay. The north-east monsoon hence commenced on the Madras coast during the first week of October. Unusually heavy rain fell over Southern India, more especially over the eastern districts of the Madras Presidency, during the month of October and the first week of November. During the whole of this interval, the period of the year when the most severe and extensive cyclones are known to occur, the Bay was entirely free from storms. In the beginning of the second week of November, the rainfall rapidly decreased in amount at Madras, and ceased entirely on the 9th and 10th. The logs of vessels shew that winds were, at that time, as they had been for some days previously, very light and variable in the neighbourhood of the Andamans and Nicobars. South-westerly winds were re-established at Nancowry on the 4th, and south-easterly winds at Port Blair on the 7th, but they were at first very weak.

The wind observations taken on board the ships Mount Stuart and Scottish Hill prove that, at the same time, winds were unusually light over the centre of the Bay, in the neighbourhood and to the west of the Nicobars and the Andamans. This condition of excessively feeble air motion was very marked on the 7th and 8th. On the 9th, there were indications for the first time of the occurrence of moderately heavy and localized rainfall to the north-east of the Nicobars, and to the east of Port Blair, and also of a shift of wind, significant of the commencement and establishment of cyclonic circulation. On the morning of the 10th, there was a well-defined atmospheric whirl to the east of Port Blair. Weather was at that time cloudy, with very light breezes, and occasional passing showers; and the sea was smooth, and free from any considerable current over the greater part of the Martaban Gulf, and the north and centre of the Bay.

The ship *Kwang Tung*, it may be remarked, passed, on the 7th and 8th, over the area in which the disturbance was generated; and there is not the slightest indication in her log, or in the observations of the neighbouring land stations, of the existence of any atmospheric whirl, large or small, at that time, or previous to the 10th. The central depression at noon on the 10th was very small, probably less than a tenth of an inch, and the atmospheric whirl, although clearly established, was as yet in an initial state. It, however, rapidly acquired increased energy during the afternoon of the 10th, and the morning of the 11th. At noon of the 11th, there was a well-defined cyclonic disturbance with its centre in Lat.  $13\frac{1}{2}^{\circ}$  N. and Long.  $94\frac{1}{4}^{\circ}$  E., the barometric depression at which certainly exceeded  $\cdot 3''$ . Strong winds were now blowing into it from the south, and bringing up much vapour. During the succeeding 24 hours, the centre moved to the north-westward through the channel separating Diamond Island and Cape Negrais from the Andaman Islands, and probably over the Coco Islands. Its centre, at noon on the 12th, was in Lat.  $15\frac{1}{2}^{\circ}$  N. Long.  $93^{\circ}$  E. The disturbance was of small extent, as vessels at distances of only 150 miles had light to moderate winds of force 3 to 5. The Satara, Byculla, and Loanda, all of which were near the centre, on the other hand, experienced squalls of terrific and hurricane force.

Hence it was at that time a small but well-defined atmospheric whirl or cyclonic disturbance. The winds and squalls near the centre were of the most violent character, the sea excessively high and dangerous, and the currents in the eastern quadrant considerable. During the next 24 hours, it retained the same characteristics, but moved very slowly to the north, so that, at noon, its centre was in Lat.  $16^{\circ} 10'$  N. and Long.  $93^{\circ}$  E. The retardation of its motion was evidently due to the resistance of the land and hills in the eastern quadrant. The centre passed a few miles to the east of the Loanda and the Byculla on the evening of the 12th and morning of the 13th. The decrease in the indraught from the eastern quadrant due to the action of the Burmese and Arakan coasts continued. The whirl began to diminish in intensity, and also recurved slightly after noon of the 13th, and passed to the north-north-eastward, thus approaching the Burmese and Arakan coasts. On the morning of the 14th, it was much enfeebled. The barometric depression was smaller in amount, the winds weaker, the rainfall more diffuse and less localised, and the sea less violent. Moreover, the directions of the winds were so irregular over the area of barometric depression as to suggest the existence of several imperfect and feeble vortices, rather than of one large and well-defined whirl. The centre of the depression was in the neighbourhood of Akyab on the morning of the 14th. The land observations at 4 P. M. of that day

indicate that the cyclonic circulation was completely broken up, and that fine weather, with moderate winds, and a slight sea, obtained at that hour in the north-east of the Bay, over which the cyclone had previously advanced. The disturbance passed so completely away on the 14th that normal north-easterly winds were re-established over the greater part, if not the whole, of the Bay, on the morning of the 15th. The storm hence was generated and dispersed between the morning of the 10th and the evening of the 14th.

The following are a few of the more important points in connection with this cyclone.

One of the more remarkable features, which has already been discussed, but which deserves special mention, was the change which occurred when the cyclone approached the Burmese coast. Whatever the explanation may be, there can be no doubt of the facts.

The following table gives approximately the position of the centre at noon on the various days, and the distance passed over by it in the preceding 24 hours :—

|      | Position of Centre. |           | Distance passed<br>over in pre-<br>ceding 24<br>hours. |
|------|---------------------|-----------|--------------------------------------------------------|
|      | Latitude.           | Longitude |                                                        |
| 11th | 13° 30'             | 94° 15'   |                                                        |
| 12th | 15° 30'             | 93° 0'    | 160 miles.                                             |
| 13th | 16° 10'             | 93° 0'    | 47. „                                                  |
| 14th | 20° 0'              | 93° 30'   | 275                                                    |

It will thus be seen that, between noon of the 12th and 13th, the storm centre began to recurve, and only advanced a distance of about 50 miles, as compared with 160 miles during the previous 24 hours, and 275 during the succeeding 24 hours. The only apparent explanation depends on what I have already suggested as probable, namely, that the cyclonic action extends through very different heights in different storms. In the storms of the rains proper, it is almost certain that the condensation, and therefore the seat of the disturbance, is at a much greater elevation than it is in storms formed during the October Transition period. In the latter case, the storms appear to be generated

near the northern limit of the retreating south-west monsoon current, which is at that period diminishing in strength. It is probably much shallower at its northern limits than elsewhere. Many of the phenomena of the cyclones of the Bay appear to be intelligible and explicable only on this supposition.

If it be granted that the October and November storms of the Bay of Bengal are formed near the northern edge of a diminishing and retreating current, it is hence almost certain that the vapour condensation, in the case of the November cyclone under discussion, occurred at a comparatively small height in the atmosphere, and that the resulting motion was mainly confined to the lower strata. Hence the effects due to friction with land, and to the destructive or disintegrating action of the hill barriers of Burmah and Arakan cutting almost radially across the cyclonic area, would be large and marked. This was undoubtedly the case. So long as the cyclone was to the south of the Burmah coast, the cyclone increased in intensity. When the centre was in a line with the coast, and at a short distance from it, retardation was at once shown, and the cyclonic or vorticose motion began to diminish. And as the centre advanced northwards, so that the Arakan hills (of greater height than the west Burmese hills) were included within the area of disturbance, the disintegrating action became rapidly more marked, and caused a speedy disruption of the vortex.

A feature which deserves special notice in the smaller cyclonic storms of the Bay is the behaviour of the barometer. The barometer affords practically no indication of the approach of a small cyclonic storm in the Bay, and should not be trusted by the mariner to give due warning. The reason of this is simple. A favourable condition antecedent to the formation of a storm is approximate uniformity of pressure over the whole or a large portion of the Bay. If a small atmospheric whirl be set up in an almost quiescent mass of air, which is therefore under nearly identical and uniform conditions, it produces a small depression at and near the centre, which extends slowly outwards. The fall of the barometer at distances of 80 or 100 miles from the centre is generally small in amount, and is frequently less than the changes due to general actions common to the whole of India. The depression at the centre rarely exceeds half an inch, and steep baric gradients are confined to its immediate neighbourhood. Over the rest of the Bay, the pressure is slightly affected by the indraught, but frequently not to such an extent as to obscure the changes going on over the whole of India. In other words, during the formation and existence of a small storm, the barometer immediately outside of the storm area properly oscillates in obedience to the larger atmospheric movements com-

mon to the whole of India, as well as to the distant storm, and hence, if used as a guide to the weather, it should be remembered that its indication may refer mainly to these general movements, and not to the whirl in the neighbourhood. Hence it cannot be used as a reliable guide to the existence of small storms in the Bay of Bengal.

A few examples from the present cyclone will not only indicate that the barometer gives no certain and marked warning of the approach of a smaller cyclone in the Bay, but suggest that the mariner in the Bay of Bengal should rely mainly on the appearance of the sky, the strength and changes of the wind, the amount of the swell, and the direction from which it travels, as indications of an approaching storm.

The Mount Stuart passed through the western quadrant. The following table gives her barometric readings, her position with respect to the storm centre, strength of wind, and amount of swell:—

|           | Barometer. | Wind.  | Swell.     | Distance of storm centre. | Weather.                  |
|-----------|------------|--------|------------|---------------------------|---------------------------|
| 7th ..... | 29.90      | 2 to 3 | None       | ...                       | Unsettled.                |
| 8th ..... | .92        | 1 to 4 | None       | ...                       | Unsettled.                |
| 9th ..... | .87        | 0 to 3 | None       | ...                       | Unsettled.                |
| 10th ...  | .86        | 0 to 4 | None       | ...                       | Unsettled.                |
| 11th ...  | .82        | 2 to 5 | None       | 250                       | Weather looking very bad. |
| 12th ...  | .75        | 5 to 6 | ...        | 100                       | Squally.                  |
| 13th ...  | .87        | 5 to 6 | Heavy sea. | 125                       | Squally.                  |
| 14th ...  | .89        | 5 to 1 | Heavy.     | 280                       | Fine.                     |

The preceding table shows that, although she was within 100 miles of the centre of a storm between the 10th and 14th, the range of the barometer at noon during the whole interval was only .14", or very little more than the diurnal range of the barometer in the Bay.

The Bancoora may be taken for another example:—

|          | Barometer. | Distance. | Wind.  | Swell.                                                         | Weather.     |
|----------|------------|-----------|--------|----------------------------------------------------------------|--------------|
| 11th ... | 29.887     | 550       | 2 to 4 | None.                                                          | Fine.        |
| 12th ... | .805       | 250       | 4 to 5 | Heavy N. E. sea.                                               | Squally.     |
| 13th ... | .770       | 70        | 3 to 7 | Tremendous sea in the morning. Heavy sea during the afternoon. | Very squally |
| 14th ... | .839       | 280       | 2 to 3 | Heavy sea.                                                     | Improving.   |

The above shows that the *Bancoora*, which left the River Hooghly on the 11th, approached within 70 miles of the centre of the cyclone at noon of the 13th. She had heavy squalls and a tremendous sea; and yet the total range of her barometer, as determined by the noon observations, was only  $\cdot 117$ ", or actually less than the diurnal range of the barometer in the Bay.

The *Satara* furnishes equally strong evidence. She was for a considerable time in the eastern quadrant of the cyclone at no great distance from the centre, and hence felt the full force of the storm.

|          | Barometer. | Dist-<br>ance. | Wind.  | Swell.     | Weather.             |
|----------|------------|----------------|--------|------------|----------------------|
| 10th ... | 29·89      |                | 2 to 5 | None.      | Fine.                |
| 11th ... | ·80        | 250            | 4 to 6 | Heavy sea. | Gale. Heavy squalls. |
| 12th ... | ·61        | 90             | 9      | Heavy sea. | Hard gale.           |
| 13th ... | ·68        | 35             | 8 to 9 | Heavy sea. | Strong gale.         |

The preceding observations show that on the 11th, when the state of the sea and the strength of the wind indicated the existence of a cyclonic storm, her barometer had not fallen a tenth of an inch. It was only on the 12th, when she was in the midst of the storm, and the wind had increased to force 9, and was blowing a hard gale, that the barometer began to fall to any considerable extent.

These examples appear to establish that the barometric movements are very small in the outer portion of the smaller cyclonic disturbances of the Bay, and are generally smaller than those due to the regular changes common to the whole of India. Hence the barometer gives little or no practical warning of the approach of a small cyclone in the Bay, and mariners should therefore rely mainly on other indications.

The path of the cyclone was contrary to all recorded experience of storms in the Martaban Gulf. The following is the list of storms that have been known to occur in that portion of the Bay, taken from Mr. Blanford's Catalogue of the recorded Cyclones in the Bay of Bengal, up to the end of 1876, in *Journ. As. Soc., Bengal*, 1876, Vol. XLVI, Pt. II:—

1840—November 21st. To the N. E. of the Andamans.

1844—November 9th—14th. East of the Andamans. Encountered by

the Briton and Runnymede troop ships. Both vessels were dismantled and thrown on the Andamans.

1850—November 17th—19th. In the Andaman Sea. Passed east of Port Blair and travelled N. N. W.

1854—April 21st—23rd. A violent hurricane in the Gulf of Martaban and Rangoon.

1858—April 9th—10th. A storm from the Andamans to Cape Negrais. Much destruction of property occurred at Henzada and Rangoon, between which the centre passed.

There is no direct evidence in this list that any of these storms passed from the Martaban Gulf into the Bay of Bengal. It is, however, probable that the third storm in the list did so. It appears to be parallel in time of occurrence, and line of advance, with the storm under discussion. There is no apparent theoretical reason in support of the opinion that a storm generated in the Gulf of Martaban should not pass into the Bay. Experience certainly appears to indicate that such a line of motion is very rare. The great majority of the cyclonic storms in the Gulf of Martaban are generated to the east of the Andamans and north-east of the Nicobars, and advance in a general northerly direction across the south coast of Burmah, when they rapidly break up.

Hence, although experience is doubtless valuable in indicating the probabilities of the occurrence of cyclones, and their line of motion, it should be most carefully borne in mind, that they are mere probabilities based, at the present time, on very limited experience, and that it would almost certainly be misleading and dangerous to dogmatize our limited experience into rules or laws, which might fail on their first application.

Another feature deserving notice was the short period of its existence. Favourable conditions, according to the condensation theory, were present for some days previous to the 10th. The log of the Kwang Tung for the 7th proves that there was no cyclonic vortex in existence in the Andaman Sea on that day. The various observations of the 8th and 9th indicate that cyclonic motion on a considerable scale had not commenced on either of these days. The observations of the 10th, on the other hand, establish the existence of a small depression on that day which rapidly developed into a large atmospheric whirl. Hence the existence of the cyclonic vortex dates from the evening of the 9th, or morning of the 10th. The circulation intensified and developed rapidly on the evening of the 10th and morning of the 11th, so that there was a large barometric depression and cyclonic circulation on that day, to the north-east of the Andamans. The cyclone was then moving north-westwards.



It continued to accumulate energy until the morning of the 12th, when the action of the land on the atmospheric motion in the eastern and north-eastern portions of the cyclone retarded the advance of the vortex, and began to influence the cyclonic motion considerably. This proceeded at first slowly, but, as the storm moved northwards, the destructive effect of the Burmese and Arakan hills increased, so that the rotatory motion was gradually and completely broken up and disintegrated before the afternoon of the 14th, in the neighbourhood of Akyab. There was thus a period of about 48 hours, from the morning of the 10th to that of the 12th, during which the storm accumulated energy. During the next 24 hours, the rotatory motion continued almost undiminished, whilst the motion of translation was largely decreased. During the remaining 36 hours of its existence, the vorticose or rotatory motion was gradually diminished.

The force of the winds at and near the centre (which might perhaps be used to measure the intensity of the storm) depends mainly upon the strength of the atmospheric disturbance producing the cyclonic motion, that is, upon the rate at which aqueous vapour is condensed into rain and upon the character and distribution of the rainfall (*i. e.*, whether it is localized and concentrated over a comparatively small area or diffused). On the other hand, the extent of area over which the cyclonic disturbance extends appears to depend mainly, if not entirely, upon the length of time that has elapsed from its formation, and during which it has advanced over the sea area uninfluenced by the land. Hence it is that the most extensive cyclones have been generated in the centre of the Bay, near the Andamans, and have advanced northwards to the Bengal coast. This is not due to any meteorological peculiarity of the Bay in the neighbourhood of the Andamans, but to the fact that a cyclone generated there, and advancing northwards, takes a longer time to reach the land than if it were formed in any other part of the Bay, and has therefore a longer period during which its energy can increase.

## CHAPTER V.

### CONCLUDING REMARKS ON THE CONDENSATION THEORY.

In the preceding pages, all the observations throwing light on the two largest and most severe storms in the Bay of Bengal during the year 1883 have been given, together with a discussion of their more important features. It remains to explain the chief features of the two storms as physical phenomena, and hence also to suggest the theory of cyclonic generation and motion which appears to be applicable to them, and is consistent with our knowledge of the physics of the atmosphere.

In both examples, the greater portion of the mass of air that was thrown into a state of violent motion during the storm was for some days antecedent to the disturbances almost at rest, and in a state of approximate equilibrium. There was a break in the rains immediately preceding the formation of the first storm, which is well-known to be a period of light and unsteady winds in Bengal, and over the Head of the Bay. The second storm occurred very shortly after the first break in the north-east monsoon rains on the Coromandel coast, and when, as the various observations prove, winds were very light and variable over the greater portion of the Bay. Hence the first and most striking feature of these cyclones was, that a vast amount of kinetic energy, or motion, was rapidly given to a large mass of air which, previously to that action, was in an almost quiescent state. The gradual increase of the motion was in those two examples proved from observations taken by vessels passing through the areas of disturbance. The transformation from the state of approximate quiescence to that of violent cyclonic motion in the Bay is consequently a continuous process, the successive stages of which can be fully traced. And the entire development of these, and of all storms in the Bay of Bengal, appears to be due to actions occurring over the Bay itself, and not to atmospheric conditions at a considerable distance from the area of cyclonic disturbance.

The question of cyclone generation is therefore essentially one of transfer of energy. Viewed in this light there are two subjects for enquiry :—

1st. The source and character of the energy which is transferred to the atmosphere, and transformed into the kinetic energy of a mass of air.

2nd. The conditions necessary for the transfer of energy under consideration.

If these two questions are fully answered, a satisfactory explanation will be given of cyclonic generation as a meteorological problem. The complete mathematical treatment of this subject as a dynamical question is beyond the scope of the present article.

The energy which is transformed during the generation and existence of a cyclone, and which maintains the cyclonic circulation against the various resistances opposing it, and therefore tending to disintegrate it, is undoubtedly the latent heat energy given out during the condensation of aqueous vapour contained in the atmosphere. In all cyclones of the Bay of Bengal that have hitherto been investigated, heavy and, in the majority of cases, torrential rain is the most prominent feature. It increases in amount during the generation of the cyclone, is excessive during the existence of the cyclone in its complete

form, and rapidly decreases during the disintegration of the cyclone, ceasing with the disappearance of the cyclonic vortex. It is thus a phenomenon parallel in character and duration with the cyclonic motion or disturbance.

It is also equally certain that when aqueous vapour is condensed into rain, practically the whole of the solar thermal energy utilized to perform the work of evaporation is given out by the mass of vapour during condensation, and is transferred to the adjacent mass of air. Major Cunningham's, Hydraulic Experiments at Roorkee appear to establish that the sun's heat under the most favourable conditions, that is, dry weather and high air temperature, does not evaporate more than one-tenth of an inch *per diem* from the surface of slowly moving water. The inverse process of condensation, in consequence of certain features of air motion dependent on rainfall, usually proceeds much more rapidly, and frequently restores the aqueous vapour in the form of rain to the earth's surface at the rate of one to two inches per hour. Prolonged rainfall at the rate of 10 to 30 inches *per diem* for periods varying from 24 to 72 hours are by no means uncommon during the passage of the larger cyclones of the Bay of Bengal across the Bengal or Madras coasts. It is probable, judging from the expressions used by sailors to describe the rainfall during cyclones in the Bay, that it is more intense and prolonged than on land.

If we therefore compare the rates at which evaporation and condensation can occur, it is certain that the energy released during the act of condensation is transferred to the atmosphere with very great rapidity during heavy rainfall and probably at a rate occasionally amounting to 100, 200, or even 400 times that at which it was absorbed during the process of evaporation. The effect of a continuous fall of 20 or 30 inches of rain over any portion of the earth's surface would, on the assumption of Major Cunningham's results, be equivalent to that of a sun 250 times as powerful as our present luminary acting directly on the mass of the atmosphere above the area of rainfall, instead of indirectly by means of convection currents due to the heating of the earth's land surface. The action is also usually continuous, and is not interrupted, as in the case of the direct solar action, by the succession of night and day. There is therefore the strongest probability that so powerful a disturbing action can produce very large and rapidly accumulating effects on the mass of the earth's atmosphere affected and influenced by it in a comparatively short space of time.

There hence appears to be no doubt that the energy transferred to the atmosphere during heavy rainfall is very large, and that the source of the energy thus indicated is adequate from every point of view to account for the production of the largest and most intense cyclonic cir-

culations. Other causes of the origin of cyclones have been assigned, as, for instance, differences of pressure, friction between parallel winds blowing from opposite directions, &c., but the slightest consideration seems to show that none of these is sufficient to account for the enormous and continuous transfer of energy that occurs during the prolonged existence of a large cyclone. The strongest argument against these theories, in the case of cyclones of the Bay of Bengal, is, that experience has established that the larger the cyclone, the smaller are the antecedent differences of pressure, and the feebler are the winds blowing from opposite directions, immediately before the formation of the cyclonic vortex.

The following statements based on the preceding remarks hence give the answer to the first part of the required explanation. When water is converted into aqueous vapour on the large scale at the earth's surface, thermal energy, derived from the sun, performs the work of evaporation, and is hence transformed. The aqueous vapour thus produced possesses an equivalent amount of energy, the greater part, if not the whole, of which it retains, so long as it continues in the vaporous condition. When it is reconverted into water, or condensed as rain, this portion of its total energy is given out, and transferred to the air. The *modus operandi* of this transfer is a matter of no importance in the present enquiry. Also, in all cases when the rainfall is heavy, and prolonged for a considerable time, the energy is given out at a much more rapid rate than that at which it was absorbed during the process of evaporation. Hence heavy and prolonged rainfall may give rise to a powerful, persistent, and continuously accumulating disturbance on the adjacent atmosphere, and, therefore, produce violent and extensive air motion. In virtue of the constitution of the atmosphere, the motion will be rotatory. Prolonged heavy local rainfall is hence an adequate and sufficient cause. It is, moreover, the only known cause which is equal or similar in amount to the effect, and hence there are strong reasons for assuming that it is the motive power which produces the peculiar motion of the atmosphere called cyclonic circulation on the large scale. It is, in fact, the most powerful disturbing action to which the air is subject, and the consequent motion of the air is, when the rainfall and consequent disturbance are excessive, the most violent in its character with which we are acquainted.

The history of the two cyclones has shewn most fully that heavy rainfall over the area of cyclonic motion or disturbance was a characteristic feature, and that in this respect they confirm previous experience. Hence the source of the energy of these two cyclones was almost certainly that which we have indicated in the previous statement, that is, the latent heat energy of the aqueous vapour derived previously from the sun, and transferred to the atmosphere during the process of condensation.

As rainfall does not always appear to produce cyclonic motion, it is clear that, although rainfall may be the source of energy, it is only when the rainfall occurs under special conditions that the accompanying air motion increases and accumulates in the peculiar manner necessary to give rise to a large and intense cyclonic circulation. Experience has shown that the following conditions, which can be proved to have a direct bearing on the formation of cyclones, are always present before and during the generation of cyclones in the Bay of Bengal :—

1st. The establishment and prevalence of a humid current over the extreme south of the Bay, which brings up large quantities of aqueous vapour into the centre or north of the Bay.

2nd. The occurrence of approximate uniformity of meteorological conditions, more especially of pressure, over the coasts of the Bay, and frequently over a considerable portion of the Bay.

3rd. The prevalence of light and variable winds over Bengal and the coasts of the Bay, and over a considerable portion of the Bay extending from the Bengal coast southwards. This condition is practically identical with the previous, as both are due to, and accompany, the same general atmospheric conditions.

4th. The absence of rainfall, and the prevalence of clear skies with fine weather, over the north and centre of the Bay, and in Bengal.

The relative importance of these conditions will be evident on very brief consideration. The first is evidently necessary to supply the aqueous vapour in sufficiently large amounts to give rise to continuous heavy rainfall over such a large area as is covered by a considerable cyclonic disturbance. The Bay of Bengal is not a large enough evaporating area to afford such a supply. Hence cyclonic storms are only formed in the Bay of Bengal when there is a humid current blowing into it from the Indian Ocean. This occurs only during the south-west monsoon period, when the south-west winds blowing at the entrance of the Bay are the northward continuation beyond the Equator of the south-east Trade Winds of the Southern Tropics. That such is the case is sufficiently proved by the fact that cyclonic storms on the large scale are entirely restricted to that portion of the year when south-west monsoon winds are blowing over a part or the whole of the Bay, that is, from the beginning of May to the end of December. It is also shown by the fact that, at the commencement and termination of the south-west monsoon period, any cyclones that are generated, form in the south of the Bay, whilst in the months of July and August, or during the height of the south-west monsoon, they form near the Head of the Bay. In short, the area of cyclonic generation in the Bay of Bengal depends mainly upon the season, and travels northwards or southwards, according as the south-west monsoon is advancing or retreating over the Bay.

The remaining conditions appear to be necessary in order that the rainfall may occur in such a manner as to give rise to and produce an atmospheric whirl. It is evident that if rainfall tends to set up rotatory motion in the air, it is absolutely necessary for rotatory motion on the large scale that there should not be several separate centres of rainfall and disturbance, each producing its own rotatory or cyclonic action, and therefore interfering with the others. It is essential that the rainfall should be localized and concentrated, that it should continue for some time over a comparatively small area, and be confined to that area. The more perfectly this is realized, and the longer this continues, the greater will be the accumulated disturbance. In order that the rainfall may occur over the same area for such a considerable period as to permit of the continuous accumulation of action, it is evident that ascensional motion should mainly occur there, and hence that, previously, there should be little horizontal motion of the air, and therefore very slight differences of pressure at the sea level. The necessity for the further conditions is hence also evident.

It will be seen that these conditions were fulfilled in the case of both storms, more completely (as might have been anticipated) in the case of the second storm, when the south-west monsoon current was weaker than it was at the time of the first storm. The history and discussion thus fully bear out the existence of the conditions immediately antecedent to the two storms which the condensation theory asserts to be necessary for the initiation and generation of a cyclonic storm in the Bay.

The preceding remarks hence indicate that the energy given out during the process of aqueous vapour condensation on the large scale is the motive power of cyclones, and that the rainfall must be localized and concentrated over a considerable area, for a period of one or more days, in order to produce the continuous and rapid accumulation of energy which characterizes a large cyclonic disturbance. Experience has also shown that the conditions which the condensation theory suggests as being essential for the occurrence of continuous and prolonged local rainfall over a portion of the Bay are exactly those which are present before and during all cyclonic storms in the Bay of Bengal, and that they are more fully marked before the occurrence of the larger than of the smaller cyclones of the Bay. It is, moreover, these antecedent conditions which form the only test or indication of the possible or probable early formation of cyclones in the Bay, and which are utilized in the preparation of the daily weather Reports issued by the India and Bengal Meteorological Departments.

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## EXPLANATION OF PLATES II—X.

The plates give the weather charts for each day during the whole period covered by the two storms of 1883 described in the preceding pages. The curved lines or isobars indicate the distribution of pressure. Along any one of these lines, the estimated air pressure at the sea-level (as determined from the reading of the barometer) is the same. Hence no change of pressure occurs along these lines, and the change of pressure is greatest perpendicularly across these lines. The rate of change is most rapid where the lines are nearest together. As the difference of air pressure between consecutive lines is the same, the rate of increase or decrease of pressure is inversely proportional to the distance between consecutive lines. The isobars form closed curves about the centre of a cyclonic disturbance. Hence the position of the cyclonic vortex on any day is at once determined by an inspection of the charts. The probable path is determined by joining these positions by lines. The direction of the air motion near the earth's surface is determined by the winds, which are shown by arrows flying with the wind, or pointing to the direction towards which the moving air is advancing. Small circles (o) indicate a calm at the hour of observation.

The charts give the distribution of pressure and wind directions at 10 A. M. of each day. They are based on the 10 A. M. observations taken at the land meteorological stations, and on the 8 A. M. or noon observations taken on board the ships which have furnished logs of the weather experienced by them in the Bay during either storm, allowance being made, wherever at is possible, for the difference of time between the two sets of observations.







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IV.—*Some Rough Notes for the Construction of a Chapter in the History of the Earth.*—By R. D. OLDHAM, A. R. S. M., Assistant-Superintendent, Geological Survey of India.

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To the coal-miner, or to the mere geological surveyor, the exact correlation of the rocks in different parts of the world is of little importance. Little does the mine-owner reck of whether his coal does or does not belong to the carboniferous era so long as it is saleable at a profit, nor need the geologist, asked to survey and report on a coalfield, trouble his head about this ; but, to one who would unravel the physics or the history of the earth, the solution of this problem may well be of paramount importance, though unfortunately often impossible of attainment ; generally, one might almost say, always, he has to depend on fossils, but the answers these give are often contradictory or Delphic in their obscurity ; at no time should they be too literally interpreted, but, like the cutcherry gong in an Indian station, must be made the most of as the only available substitute for a more accurate timepiece. But just as in this city where there are many thousand timepieces of various descriptions, of which probably no two keep identical time, every day the time-ball falls and the signal gun is fired to let all who may be concerned know that it is one o'clock ; so in the past time-signals have been given throughout the earth, by which we can determine the contemporaneity of the strata in which their records have been preserved. Of this nature would be a wide spread glacial epoch comparable to that which in the

recent past has affected both hemispheres of the globe, but, as there is reason to believe that such have occurred at various periods in the history of the earth, we are dependent on the otherwise less accurate palæontological evidence for determining whether the strata shewing signs of glacial action can have been deposited at the same period or must belong to widely separated geological epochs.

There can be no doubt that of all forms of palæontological evidence the most trustworthy is that afforded by the marine mollusca. Inhabiting as they do an element of more uniform temperature, and of which every part is in continuous if circuitous connection with the rest, it is but natural that they should be more uniform in character than the fauna of the land, while the simplicity of their structure, greater than that found among vertebrates or higher invertebrates, renders them less liable to change through alteration of the conditions under which they live. On the other hand, this very stability of organism renders them useless for the exact correlation of strata far separated from each other; for mere determination of homotaxy, even did this exist in the sense in which the term was originally intended to bear, would be but of little value to the physical geologist, to whom the terms 'Jurassic' or 'Carboniferous,' if determined merely on palæontological grounds, are as meaningless, for determination of dates in the history of the earth, as the analogous terms 'Stone Age' and 'Bronze Age' are for determining periods in the history of the human race.

But, if the evidence afforded by marine mollusca is not sufficiently accurate and trustworthy, how much more is this true of that afforded by the terrestrial fauna and flora. True, the duration of the existence of a species of cycad, conifer, and, possibly, even a fern may be shorter on the average than that of a species of mollusc, and to this extent it may be a more accurate index of contemporaneity; but it is comparatively seldom that identical species are found in far separated deposits, and palæontologists have consequently to depend mainly on what are called 'allied species.' Now the hard parts of animals, which in almost every case are all that are preserved to us, give, for the most part, a very true and real indication of the affinity of the animal to which they belonged, while, from the leaf of a tree or the frond—generally barren or with the fructification obliterated in fossilization—of a fern, little or nothing can be gleaned of the relationship of the plant to which it originally belonged; thus no one would doubt that two specimens of *Terebratula* or Ammonite, declared by a competent palæontologist to belong to the same species, would, if we could recover their soft parts, still prove to belong to the same or very closely allied species, while, on the other hand, we have lately been informed, by a palæobotanist whose competence none

can doubt, that the Indian and Australian forms of the celebrated *Glossopteris browniana*, long believed to belong to the same species, differ so widely in their fructification that it is doubtful whether they can be included in the same family, and that they must certainly belong to different genera.\*

As an instance of uncertainty of palæontological evidence, I need only quote the well-known case of the Umia and Katrol beds of Kutch, where beds containing a flora with a well-marked Lower Oolite facies overlie other beds in which the fauna is equally distinctly Upper Oolite in type; another case that might be quoted is that of the Rajmahal and Damuda floras; in the Rajmahal flora, there are, out of 47 species† in all, 26 which are identical with or allied to‡ European species: of these, fifteen are represented in the Rhætic beds of Europe, one species being hardly distinguishable from the European form: seven are represented by Palæozoic species, two belonging to an exclusively Palæozoic genus (*Eremopteris*), while another (*Macrotaeniopteris lata*) is, on Dr. Feistmantel's own admission, so like the Permian *Terniopteris abnormis* as to be almost undistinguishable: two species only are allied to Liassic forms, and of these one is also represented in the Rhætic: five species are represented in the Lower Oolite of Europe, two by identical forms, while, of the other three, one is also related to a Carboniferous, and the other two to Rhætic, species. From this, an impartial observer would be inclined to place the flora as certainly not later than Rhætic, but, as on this point the talented palæontologist of the Geological Survey has expressed a very positive opinion that the flora is Liassic in facies, I must perforce

\* Palæontologia Indica, Fossil Flora of the Lower Gondwanas, Vol. III, p. 103. In this connection, I may quote Dr. Feistmantel as follows:—after noting the difference in the fructification of the two forms, he adds 'so that I would be quite justified in placing these in a separate genus altogether and thus disposing of the difficulty in determining the age of our Damuda series owing to the correlation of the Indian Australian species.' An easy way of 'disposing of the difficulty' forsooth, but my colleague can hardly have perceived the full force of these words when he penned them, for, carried to their legitimate conclusion, they cut away the ground on which alone palæobotanists can base their claim for the acceptance of fossil plants as a means of correlating distant deposits. The lesson to be learnt is rather that the conclusions of even the ablest palæobotanists must, owing to the nature of the material they have to work with, be received with caution, and that generic and specific names of fossil plants do not necessarily represent any real affinity, and that in some cases the latter and in most cases the former are names merely and nothing more.

† Here and elsewhere, except where the reverse is distinctly stated, I owe my palæontological facts to Dr. O. Feistmantel's writings in the publications of the Geological Survey of India.

‡ I use this term in the same sense as it is used by palæobotanists; it may well be that some of these 'allied species' have no real connection with each other.

how to his opinion, a feat I can the more easily perform that the exact determination of the age of the Rajmahal series is irrelevant to my present purpose, this being merely to point out, that the flora, judged by European standards, is of an extremely heterogeneous character.

Turning now to the Damudas, we find that, out of a total 63 species, only twenty shew any affinity to European forms: of these, six are represented by Rhætic species, two of which are identical in Europe and in India: eight are represented in Jurassic beds, one being identical with a species from the Yorkshire Oolite, and two have their nearest allies among living forms: while, of those which are related to species older than the Rhætic, two are represented in the Permian, and two only are represented by allied species in the Trias. The flora of the Damudas is thus seen to be as heterogeneous in its character as that of the Rajmahals and, like that of the latter, would naturally be attributed to a Rhætic age, yet the two series are not merely separated by a break in the stratification, but the two floras are so contrasted in their characters that, whereas the Damuda flora is almost exclusively composed of ferns, that of the Rajmahals is markedly the preponderance of cycads, and, of all the Rajmahal species, three only are represented in the Damudas and those by "allied species." These beds have been classed by Dr. Feistmantel as Triassic, and the probabilities in favour of their being contemporaneous in the Trias of Europe are about the same as those in favour of a Liassic age for the Rajmahals or a Rhætic age for either of the two, but this is all that can safely be said.

Turning now to the Kach flora, which, whether we judge from the associated marine fauna or from the flora itself, is of Oolitic age, we find, out of a total of 27 (excluding Algæ) species, 18 are represented by identical or allied species in Europe, four are identical with European Oolitic species, of which, however, one ranges down to the Rhætic, nine more forms are related to European Oolitic species, while four only are related to species older than the Oolite and in two cases at least the relationship is not very close; we have here, then, a much closer relation with a definite European flora than is the case with the Damuda and Rajmahal beds, and this, as I shall presently shew, is of considerable importance in unravelling the history of the Gondwana age.

In Australia, there is a series of plant-bearing beds whose flora shews many affinities with that of the Indian Gondwanas, but which range over a more extensive period of time, and are marked, both at their upper and at their lower limits, by the association of the plants with marine fossils.\*

\* *Conf.* principally Rev. W. B. Clarke, Remarks on the Sedimentary formations of New South Wales, 4th edition, and Dr. O. Feistmantel in *Palæontographica*, 1878 (Appendix).

At the base of the series, are beds whose marine fauna indicates a Devonian age; above these, come beds which contain a flora consisting principally of such genera as *Lepidodendron*, *Rhacopteris*, and *Calamites*, among which occurs a single species of *Glossopteris*.\* Above these, but still below beds in which a marine fauna of Carboniferous type is found, there is a flora which, judged by European standards, is Mesozoic in facies. At the top of the Newcastle series, to which the beds just mentioned belong, a more abundant flora is found, which presents many relationships to that of our Indian Damudas: in both, *Glossopteris* is a dominant type, both contain the *Glossopteris browniana* and two other species allied to Damuda forms: *Sphenopteris*, which in the Newcastle beds is represented by six species, is only represented in the Damudas by one (*S. polymorpha*, Fstm.), which, however, is said to be more closely allied to the Australian *S. alata* than to any European form: the only species of *Phyllothea* is allied to the Damuda *P. indica*, and the common occurrence of *Vertebraria* in both is another link. That this relationship is not so close as was at one time believed, I readily admit, but nevertheless the relationship is real, and, though it may be presumptuous to express an opinion at variance with that of the talented palæontologist of the Geological Survey of India, I must say that to me the relationship seems far closer than that which unites the Damudas to the Trias of Europe.

Above the Newcastle beds, come the Hawksbury beds, which have yielded but two species of ferns, one of which (*Sphenopteris alata*, Bgt.), however, is allied to a Damuda species. Above the Hawksbury, come the Wianamatta beds, which have yielded six species of plants, no less than three of which are allied to Damuda forms.

It is thus evidently impossible to correlate, on palæontological grounds alone, these beds directly with any of our Indian horizons, but, like the Indian Talchirs, the Hawksbury beds contain certain beds of fine clay through which boulders of all sizes are scattered promiscuously in a manner that can only be attributed to the agency of floating ice. In Victoria, there are beds which similarly indicate the existence of a severe climate at the time of their deposition, and these—the Bacchus Marsh beds—have yielded three species of *Gangamopteris*, of which one is identical with, and the other two are closely allied to, Talchir species. The Bacchus Marsh beds have not yielded a single species common to themselves and to the Hawksbury beds, but this is of little importance, as it is impossible to suppose that the entire flora of the Bacchus Marsh period consisted

\* There is some doubt attaching to the correctness of this statement. The *Glossopteris* was obtained from a different locality and possibly from a newer series of beds than the others.

of three species of *Gangamopteris*, or that of the Hawksbury period to have been limited to two species of ferns. But, if not directly referable to the same epoch by their contained fossils, there can be no doubt that they are on the same horizon, for, in the uppermost beds of the Newcastle series, two species of *Gangamopteris* are found, one identical with, and the other allied to, species from the Bacchus Marsh sandstones of Victoria, while the beds above the Hawksbury series in New South Wales can be correlated with those which overlie the Bacchus Marsh beds in Victoria by the occurrence of *Pecopteris australis*, Morr. and *Tenopteris daintreei*, McCoy in both. The presence of beds indicating glacial action in both and the absence of similar beds in the associated strata further prove their absolute contemporaneity; and by an extension of the same reasoning we may assign the Talchirs of India to the same glacial epoch.

The palæontological relations of the Gondwanas with the Karoo and Uitenhage series of South Africa are much simpler than with the Australian formations. From the upper part of the Karoo beds, which unconformably overlie strata containing an Upper Palæozoic fauna, a limited flora of but five species has been obtained. Of these five, one is *Glossopteris browniana*, another, *Dictyopteris? simplex*, Tate, is, according to Dr. Feistmantel, allied to *Glossopteris damudica*, Estm., and *Rubidgea mackayi* is, on the same authority, probably a *Gangamopteris*; in addition to these, Tate gives a species of *Phyllothea*, but the identification is doubted by Dr. Feistmantel.\* Associated with these, there is an abundant and peculiar Reptilian fauna with *Diapsodon* as a dominant type, a genus not known elsewhere, except from the Panchet subdivision of the Damuda in India. In the overlying Uitenhage series, there is a flora consisting of eleven determinable species; of these one species of ferns is also found in the Rajmahals, while two, and possibly three, species of ferns and one conifer are closely allied to Rajmahal forms.† These Uitenhage plants are associated with beds containing an Oolitic marine fauna. The palæontology of these beds sufficiently indicates a parallelism with the Gondwanas, and, in confirmation of this, we find, at the base of the Karoo series, an undisputably glacial boulder bed,‡ which we shall be justified in assigning to the same epoch as those of the Talchirs in India and of the Hawksbury and Bacchus Marsh beds in Australia.

Viewing these circumstances, there can, I think, be no doubt that these glacial boulder clays of Africa, India, and Australia represent one and the same epoch in the history of the earth and are, as strictly as the word can be applied, of contemporaneous, if not absolutely coeval, origin.

\* Q. J. G. S., XXIII, 140, *Palæontographica*, 1878, p. 114.

† Q. J. G. S., XXIII, p. 140.

‡ Q. J. G. S., XXVII, 58 and 535.

And further, as in every case the palæontological evidence indicates that these glacial beds are of late Palæozoic or early Secondary age, I think it is probable that, as has been suggested by Mr. H. F. Blanford, they are of the same age as the Permian boulder clays of Europe.\*

Having thus obtained a common era in the geological history of these three countries (India, Africa, and Australia), we are able to examine their history in an intelligent manner. The first thing noticeable is that, in Australia, at a period corresponding fairly to the Devonian, both the fauna and the flora were, judged by European standards, of a Palæozoic type. Later on, probably in Lower Carboniferous times, there appears, among species of *Lepidodendron*, *Rhacopteris*, and *Calamites*, which, in Europe, are found in rocks of Carboniferous age, a single species of *Glossopteris*, the forerunner of a newer flora destined to supplant the older forms. In the Newcastle (Upper Carboniferous) beds, this flora has completely ousted the older forms, and, as I have already noticed, shews considerable relationship to that of the Damudas in India. Yet, if the Talchirs and the Bacchus Marsh beds are really of contemporaneous origin as was first suggested by Dr. Feistmantel, and if the Bacchus Marsh and Hawskbury beds are also contemporaneous (and the presence of traces of glacial action in all three is at least presumptive evidence in favour of this conclusion), the Damudas must be of very much later date than the Newcastle beds, and we have to explain why it is that the Newcastle flora left Australia when it did, and why it or its descendants lingered on in India, and, as I propose to shew, spread over what is now the Old World producing important modifications in its flora.

It is possible to suppose that the Newcastle flora required a warm—though from internal evidence one would rather look upon it as indicating a cool temperate—climate; that, on the advent of more severe conditions, it migrated towards the Equator and remained there, not merely through a period of extreme severity, but through a further period, when the climate was cooler than it had been during the deposition of the Newcastle beds, and during which a flora more suited to the latitude flourished in Australia. But there are so many objections to this hypothesis that it can hardly be tenable, and, however wild my alternative hypothesis may be thought, I hope to prove that it is really the more probable of the two.

In the first place, we have to account for the prevalence of glacial conditions at a low level in India even within the tropics. This was not paralleled during the last glacial period, for even the erratics of the Petwar are 10 degrees beyond the tropics and 2,000 feet above the level

\* This correlation of the Indian, African, and European boulder beds has been suggested by Mr. H. F. Blanford, Q. J. G. S., XXI, p. 519.



of the sea, while the Petwar was certainly not less elevated during the glacial period than it is now. Further, the glacial deposits in India are far better developed, and, to judge from the descriptions, must be far thicker and represent a much longer period of time during which the climate was severe than those in Australia. Yet the glacial deposits of New South Wales are  $10^{\circ}$  further from the Equator than the Indian, so that, if we might shift the Equator some  $10^{\circ}$  further south between India and Australia, observed facts would be more in accordance with what one would expect than can be the case if we are compelled to assume the Equator fixed throughout all time.

But, if we try to compare the facts observed in Australia and Africa, we are landed in a still greater difficulty, for, lying as they do on about the same parallel of South Latitude, the glacial beds are more strongly developed in Africa even than in India; and, as we can hardly suppose the greater severity of climate to be due to altitude, it must have been due to latitude, to obtain which we must suppose that that portion of the Earth's crust which now forms South Africa then lay in a higher latitude than that which is now Australia; in other words, the comparison of the Permian (?) glacial beds of Africa and Australia, as in the case of Australia and India, points to the conclusion, either that there has been a change in the position of the axis of revolution of the earth, or, what is more probable, that the crust of the earth then occupied a position relative to the central nucleus different from that which it now does. An experiment with a globe will shew that the relations of India, Australia, and Africa indicated above, viz., that Central India was in a higher latitude than New South Wales and South Africa in a higher latitude than either, are best satisfied by taking the Equator between India and Australia, but nearer the latter than is now the case, and thence through a point lying between the Cape of Good Hope and the South Pole in not less than  $70^{\circ}$  of South Latitude; a disposition which would bring some point in Central Africa over one of the poles.

Turning now from these physical and climatic arguments to those derivable from palæontology, I hope to shew that they lead to the same conclusions.

I have already referred to the fact that the Damuda and Rajmahal floras of India shew affinities with those of almost every division of the Mesozoic era in Europe, and I would now draw attention to the fact that those species which are related to upper Secondary forms in Europe belong very largely to types which first appear in the Palæozoic beds of Australia. Foremost among these, of course, are *Glossopteris*, *Phyllothea*, and *Vertebraria*; not known in Europe before Jurassic times, these were certainly living in Australia at the commencement of the Carboniferous epoch. *Pecopteris*, *Thinnfeldia*, *Gangamopteris*, *Næggerathiopsis*

likewise are found in the Newcastle series of New South Wales, but in Europe only in Secondary beds. Allowing that some of these genera are purely artificial, and that the species grouped under them may not really be allied in every case, it is on the other hand probable that some forms placed under distinct genera should properly be united with some of those grouped under the genera above mentioned, and, making the most liberal deduction for the value or want of value of negative evidence, I think that there is still a very considerable weight of probability, on this count alone, in favour of a newer type of vegetation having originated in Australia in Palæozoic times and in the Permian period commenced to spread over the rest of the world.

The explanation seems to be that, on the advent of the Glacial period, the flora, which had supplanted the older types in Australia, was driven towards the Equator. As the climate ameliorated, it did not again retreat towards Australia, either because its place was taken by newer species, or, more probably, because, owing to changes in the distribution of land and water, it could no longer do so, but to the north—or what for convenience we may provisionally call the north,—of the Equator it lived on in what is now India, and, gradually spreading over the hemisphere, produced a profound modification in the pre-existing floras of what we now know as the Old World.

The flora of the Wianamatta beds, as I have explained, shews a certain relationship with that of the Damudas, but none with that of the Newcastle beds as far as species go; of the genera, however, three out of the six, or, if we include the Hawksbury beds, four out of seven are also found in the Newcastle beds. The beds newer than the Wianamattas have yielded a flora consisting of nine species belonging to seven genera, of which, if we except the *Phyllothea australis*, only one species is allied to an Indian form, viz., *Pecopteris australis*, Morr. allied to *P. indica*, Oldh. and Morr. from the Rajmahals. We have here a distinct decline in the closeness of relationship between the Indian and Australian floras, and, though, of course, this might be due to the imperfection of the record, the probabilities are against its being entirely due to that cause, and we may safely conclude that some barrier separated the two areas, by which the floras of India and Australia were kept apart and followed separate and consequently diverging lines of descent.

Turning now for a while to South Africa, I must commence by declaring it as my opinion that the relationships between the Indian and African floras of the periods I am discussing are with difficulty explicable, unless it is granted that there was in those days a continent, or at any rate a continuous chain of islands, stretching from South Africa towards India. I am aware that Mr. A. R. Wallace has declared such to be uncalled for and

impossible to grant,\* and I am ready to admit that the facts of distribution of animals as detailed by him are conclusive against the possibility of such a distribution of land and water, at any rate since the Miocene period. But there is no reason to suppose that the present distribution of plants or animals can throw any light on the distribution of land and water in late Palæozoic and early Secondary times. On the other hand, in favour of the land connection, I claim, *firstly*, that the relationship between the fauna and flora of the Damudas on the one hand and the Karoo beds on the other is far more real and close than the mere 'similarity of animal and vegetable productions' to which Mr. Wallace seems to have considered it to be confined; *secondly*, that this relationship of the two floras continued into the Uitenhage and Rajmahal series, which could hardly have been the case had the two areas been as separated then as now; and, *thirdly*, that the very peculiar relationships and differences between the cretaceous faunas of Central and Southern India on the one hand and Arabia and South Africa on the other are such as imperatively to demand the existence of a continuous barrier of dry land stretching between India and Africa. It is needless to expatiate further on this point, for, if such a barrier existed during the Cretaceous period, any argument against its possibility derived from the doctrine of the permanence of continents must fall to the ground, and there remains no reason why, if on independent grounds its existence is shewn to be probable, such a modification as I require may not have existed at the commencement of the Secondary period. That, during the deposition of the Damudas, there was continuous land communication with South Africa I do not suppose, for the very remarkable reptilian fauna, which, like the recent marsupial fauna of Australia, mimicked many of the higher mammalia, points rather to some isolated continental island which was connected with India, as Australia now is with Asia, by a chain of large islands separated by narrow straits, across which the spores of ferns and the seeds of plants could be wafted, but which were impassable to terrestrial reptiles.

But even a land connection of this sort would probably be inadequate by itself to account for the close relationship which the small fragment preserved to us of the flora of the Uitenhage period shows to that of the Rajmahals. For it is at least highly probable that the heat of the Equator would be as effectual a barrier as a broad sea, and, if the floras of India and Africa had pursued independent courses of development for a period sufficient for the dying out of every species and almost every genus, and for a change in the facies of the flora from one composed mainly of ferns to one composed mainly of cycads, it is inconceivable that the floras of the Uitenhage and Rajmahal series should exhibit the close

\* Island Life, p. 398.

relationships they do. But this difficulty would not exist could we suppose that what are now South Africa and India then lay on the same side of the Equator; and thus the palæontology of these beds, as well as their petrology, points towards the conclusion that in early Secondary times the crust of the earth did not occupy the same position with respect to the axis of rotation as it now does.

That none of these arguments are conclusive by themselves I admit; I willingly admit that the floras preserved to us represent but a fraction of the species that lived when the beds that have yielded our fossils were being deposited, but the probability is vastly against only those species which were related to each other in the two countries being preserved, and we may, I think, safely argue from the small sample preserved to the larger bulk which is lost. In the same manner, I freely admit that the differences in the severity of climate may have been due to other causes besides difference of latitude, but on the average a colder climate indicates a higher latitude, and, when we find that, from whatever point we approach this matter, we are led towards the same conclusion, it seems to me that there is a very strong presumption in favour of its truth.


I fear this paper has already extended to too great a length for me to examine the arguments that have been put forward to prove that any change of latitude is physically impossible, but I cannot conclude without pointing out that what has been proved is that no conceivable elevation or depression of the earth's surface could produce an appreciable alteration in the axis of rotation of the earth as a whole. But, though the mathematical reasoning on which this conclusion is based may be unassailable, it has no bearing on the question of whether changes of latitude may not have taken place in the past, except on the assumption that the earth is rigid throughout, and that the crust has no power of sliding over the heated if solid core, an hypothesis which has been ably combated by the Rev. O. Fisher,\* and which I hold to be inconsistent with the known facts of stratigraphical geology. While, if the views put forward in this paper are true,—and there seems to me a very strong presumption in their favour,—the crust of the earth must in Mesozoic times have occupied a very different position with reference to the axis of rotation from that which it does at the present day.

As yet the only fact which has in any material degree attracted the attention of English geologists is the prevalence during the past of mild climates within what are now the Arctic regions; and hypotheses have been broached to account for this independent of an alteration of the position

\* *Physics of the Earth's Crust passim*; see particularly p. 184.

of the crust relative to the central core of the earth; but the more completely such an hypothesis may explain the absence of any trace of glaciation in the Palæozoic, Secondary, or Tertiary rocks of the Arctic regions, to which Baron Nordenskjöld has drawn our attention, the more irreconcilable is it with the repeated traces of glacial action that are met with almost within the tropics. Yet the latter as urgently requires explanation as the former, and I have put these suggestions forward not from any conviction of their intrinsic truth, but because I feel that the rigid bonds within which mathematicians have sought to confine geologists must be largely and materially relaxed, because I feel that every addition to the growing pressure against these bonds is of some—even if but small—importance, but chiefly because I trust that I may be instrumental in drawing the attention of others with greater opportunities and greater abilities to the solution of this problem.

P. S.—Just a week before this paper was read Mr. W. T. Blanford, addressing the geological section of the British Association at Montreal, devoted the greater part of his address to the consideration of a subject to which he has before now referred, more particularly in the Records of the Geological Survey of India, and on which I have cursorily touched in the introductory part of this paper; I mean the uncertainty of palæontological evidence in determining the exact correlation of widely separated beds. He also refers to a report on the Stormberg coal-fields by Mr. E. J. Dunne, which I have strangely overlooked: Mr. Dunne mentions the existence of three species of plants in the Stormberg beds identical with Australian species, an identification which, if correct, greatly diminishes, if it does not altogether annihilate, the value of my argument from the relationships between the African and Indian early Secondary floras, but this is of the less importance, as, owing to the known value or want of value of negative evidence in palæontology, little value would in any case attach to an argument of this kind.



V.—*A new Species of Simulium from Assam.*—By DR. EDWARD BECHER, Vienna. Communicated and translated by the NATURAL HISTORY SECRETARY.

[Received October 13th;—Read November 5th, 1884.]

(With Pl. XIV.)

*SIMULIUM INDICUM*, nov. spec.

♀. *Caput et thorax brunneo-nigra; thorax convexus, scutellum nigrum; palpi 4-articulati, fusci; antennae 10-articulatae, fuscae; alae magnae, latae, nervi costales crassiores quam reliqui; pedes varii: femora et tibiae in basi flavae, in apice fuscae, tarsi fusci; abdomen breve, segmentum primum latissimum; hoc et trium sequentium pars ventralis flavicans, caetera subfusca. Longitudo 3 mm.*

Head free, standing pretty low; brown-black; forehead broad, clypeus short, nearly vertical; eyes kidney-shaped, with a moderate notch for the reception of the first antennal joint. Ocelli wanting. Antennae dark brown-black, 10-jointed; the second joint distinctly constricted off from, and equal in length to, the first, and longer than the rest; the three succeeding joints broader than long, telescoped into one another; the four next equally long and broad, each tapering to the apex, the last joint pointed at the apex, somewhat longer than the preceding.

Proboscis salient, dark; mouth-parts differing in matters of detail only from those of the typical form: palpi dark, 4-jointed, the basal joint lighter; the first joint short, the palp-scale resembling it and thus apparently representing a fifth joint, the second and the third joints almost of the same length, the fourth  $1\frac{1}{2}$  times as long as the third, all the joints pretty equally broad and moderately bristly.

Thorax brown-black, high-arched, without transverse suture, tergum and scutellum velvet-black, somewhat shining, sides of the thorax lighter, especially near the coxae of the first pair of legs.

Wings\* large and broad, the marginal vein thick, terminating before the apex of the wing, the anterior branch of the first longitudinal vein

\* In order to facilitate comparison with other descriptions, the usual nomenclature of the veins of the wings is retained in the following description. According to Adolf's theory, the veins should, in consideration of Brauer's work on this subject, be named as follows:—the anterior branch of the first longitudinal vein = the auxiliary vein (*Hilfsader*); the principal branch of the first longitudinal vein = the first longitudinal vein; the small transverse vein = the trunk of the third longitudinal vein; the third and the fourth longitudinal veins = the third longitudinal vein; the succeeding fold = the fourth longitudinal vein; the fifth and the sixth longitudinal veins = the fifth longitudinal vein; the fold = the anal vein (*Conf.* Brauer, Denkschr. d. Kais. Akad. d. Wissen. Wien, Math. Nat. Cl. Bd. xlv, 1882, p. 90, and Wiener Ent. Zeitschr. ii, 1883, Heft 2, p. 27).

short, scarcely reaching the middle of the wing, the principal branch longer, running out near the third longitudinal vein; the second longitudinal vein wanting; the third branching off from the first before the middle, running into the marginal vein far before the apex of the wing; the three first veins thick and distinct; the succeeding ones very weak; the fourth longitudinal vein forked at the so-called small transverse vein, the prongs of the fork hence much longer than the handle, the upper prong slightly bisinuous, the lower almost straight; the fifth vein straight, a little bent outwards; the sixth strongly bisinuous; the axillary vein not reaching the hinder margin, slightly sinuous; between the fourth and the fifth veins a straight, very distinct fold; a similar though weaker fold behind the sixth vein. Halteres uncovered, dazzling white.

Legs: coxæ dark, trochanter long, yellowish; femora and tibiæ throughout black-brown, metatarsus lighter at the base, a little shorter than the tibia; all the tibiæ with spurs, metatarsus of the third pair of legs notched at the apex (figs. 5, 6), those of the two first pairs truncate, spurred; the fourth tarsal joint expanded into a heart-shaped figure; the fifth longish clavate, with long divergent curved bristles, which in the first pair of legs are seated on the third tarsal joint; legs thickly covered with hairs, particularly on the tarsus, ungues small, pulvilli rudimentary.

Abdomen short, of eight segments; the first segment is the broadest and, like the sternal parts of the three succeeding segments, yellowish; the genital parts a little projecting.

The above-described species of *Simulium* is the first that has yet been made known from Asia, as only a few non-European forms have hitherto been described, whereas the number of European species is not inconsiderable.

The larvæ and the pupæ (figs. 11, 12, 13) of the European species live in water; the latter in conical (*tüfenartigen*) cocoons attached to stones, stalks of grass, confervæ, and the like.

#### EXPLANATION OF PLATE YIV.

Fig. 1. *Simulium indicum*, ♀, × 8. Fig. 2. Wing × 8. 3a. A leg of the first pair × 15. Fig. 3b. Tarsus of the same leg × 60. Fig. 4a. A leg of the second pair × 15. Fig. 4b. Tarsus of the same × 60. Fig. 5a. A leg of the third pair × 15. Fig. 5b. Tarsus of the same × 60. Fig. 6. Head from in front × 30. Fig. 7. Antenna × 90. 8. Mandible × 90. Fig. 9. Hypopharynx × 90. Fig. 10. Maxilla and palp × 90. Fig. 11. Larva of *Simulium ornatum*, Mg. × 6. Fig. 12. Pupæ of *Simulium* sp. in its conical cocoon.

VI.—*Variations of Rainfall in Northern India during the Sunspot Period.*—By A. N. PEARSON, Esq., *Officiating Meteorological Reporter for Western India.* Communicated by the PRESIDENT.

[Received October 6th;—Read November 5th, 1884.]

(With PL. XI.)

Mr. S. A. Hill, in his paper on the “*Variations of Rainfall in Northern India*,” published in the *Indian Meteorological Memoirs*, Vol. I, showed very clearly the opposition that exists between the variations of the winter and of the summer rainfall in Northern India during the sunspot period. For the purpose of bringing forward with greater clearness the main points of his investigation, he put the actual rainfall totals—which, as they stood, showed considerable apparent irregularities—through a simple process of smoothing such as is frequently adopted in dealing with statistical tables, and, by so doing, eliminated the apparent irregularities. But it appears to me that the unsmoothed results present points of interest over and above those that are presented by the smoothed results; that, in fact, the apparently irregular variations are regulated in a very definite manner.

In the table here given, I reproduce the general means of Mr. Hill’s Tables II and IV, together with the smoothed results as he gave them in the text.

*Variations of the Rainfall for each Year of the Eleven Year Cycle  
in Percentages of the Local Means.*

| Year of the<br>Cycle. | Winter Rainfall. |           |             | Summer Rainfall. |           |             |
|-----------------------|------------------|-----------|-------------|------------------|-----------|-------------|
|                       | Unsmoothed.      | Smoothed. | Difference. | Unsmoothed.      | Smoothed. | Difference. |
| 1st                   | — 17·6           | — 17·1    | — 0·5       | + 0·8            | + 3·6     | — 2·8       |
| 2nd                   | — 4·6            | — 13·6    | + 9·0       | + 12·7           | + 7·4     | + 5·3       |
| 3rd                   | — 25·6           | — 18·8    | — 6·8       | + 3·3            | + 9·8     | — 6·5       |
| 4th                   | — 19·5           | — 20·4    | + 0·9       | + 19·8           | + 12·6    | + 7·2       |
| 5th                   | — 17·0           | — 7·8     | — 9·2       | + 7·4            | + 7·8     | — 0·4       |
| 6th                   | + 22·1           | + 23·1    | — 1·0       | — 3·5            | — 5·6     | + 2·1       |
| 7th                   | + 65·4           | + 35·6    | + 29·8      | — 22·7           | — 10·8    | — 11·9      |
| 8th                   | — 10·4           | + 15·7    | — 26·1      | + 5·6            | — 8·1     | + 13·7      |
| 9th                   | + 18·3           | + 10·2    | + 8·1       | — 21·0           | — 10·0    | — 11·0      |
| 10th                  | + 14·9           | + 4·9     | + 10·0      | — 3·6            | — 7·0     | + 3·4       |
| 11th                  | — 28·6           | — 14·9    | — 13·7      | + 0·2            | — 0·6     | + 0·8       |



The smoothed numbers of the above table are curved in the accompanying diagram (Pl. XI) in thick continuous lines, under the names "Winter Rainfall, A" and "Summer Rainfall, B." The figures so produced are identical with the curves given by Mr. Hill in his paper. The unsmoothed numbers of the above table are in the diagram superposed in dotted lines upon the smoothed curves. At the bottom of the diagram, I have reproduced the sunspot curve as given by Mr. Hill.

On inspecting the smoothed rainfall curves, it will be seen that the winter and the summer curve both agree in showing a single oscillation during the eleven years of the sunspot period; but they differ in the character of that oscillation; for, while the winter rainfall is at its maximum during the year of sunspot minimum, the summer rainfall on the contrary is then at a minimum. This is the main fact pointed out in the paper above quoted.

On inspecting the actual figures, however,—the unsmoothed numbers in the above table and the dotted curves A and B of the diagram—it will be seen that, besides this eleven yearly oscillation, both the winter and the summer rainfall show several variations of minor period such as one might naturally suppose to be accidental; thus the winter rainfall shows three distinct maxima, one in the 2nd year of the sunspot cycle, one in the 7th year, and one in the 9th and 10th, and shows marked minima in the 3rd, 8th, and 11th years; while the summer rainfall has maxima in the 2nd, 4th, and 8th years and minima in the 3rd, 7th, and 9th.

It is to these minor period oscillations that I wish in this short paper to call attention. And, in order that they may present themselves in a more convenient form for study, I have separated them from the eleven yearly oscillation by the simple method of subtracting the smoothed numbers in the above table from the unsmoothed. The differences are curved in the diagram under the name "Minor Oscillations of A and B," the winter oscillations being given in dot-and-dash lines, and the summer in simple dotted lines.

Confining attention to these "minor oscillations" curves, it will be noticed that, in those years which at the foot of the diagram are marked +, and which are years of maximum sunspot, the short period oscillations in the winter and the summer rainfall are of the same character, that is to say, that when there is more winter rain there is more summer rain, and when there is less of the one there is less of the other also. But it will be seen that, in those years which at the foot of the diagram are marked —, and which are years of minimum sunspot, the short period oscillations in the winter rainfall are of opposite character to those in the summer rainfall, that when there is more rain in the winter there

is less during the summer, and *vice versa*. Again, in those years which in the diagram are marked  $\pm$ , and which immediately precede the years of sunspot maximum and minimum, the order above pointed out obtains only in a slight degree; in other words, these are years of transition.

That these facts are purely the result of accident seems very unlikely, for they are supported by three other series of concurrent facts; which are as follow:—

1st. The *plus* years begin immediately after the sunspot maxima, and the *minus* years begin immediately at the sunspot minimum.

2nd. There are more transition years during the slow descent of the sunspot curve than during its rapid ascent.

3rd. The oscillations of both the winter and the summer rainfall are of greater amplitude during the *negative* years than during the *positive*.

With reference to the first of the above series of facts, it might be supposed that, as the *minus* years begin immediately at the sunspot minimum, so for perfect analogy the *plus* years should begin immediately at the sunspot maximum. But this is by no means necessary, for the slight delay in the coming in of the positive years agrees very well with the slow descent of the sunspot curve as compared with its rapid ascent.

The main fact which I have pointed out in this paper,—namely, that the smaller variations of the winter rainfall are the same in character as those of the summer rainfall during years of maximum sunspot; and opposite in character during years of minimum sunspot,—if it can be established as a general rule, will be an important one; for it will indicate that, whatever be the cause which produces the general opposition in character between the eleven yearly variations of the winter and of the summer rainfalls, that cause operates chiefly during the years of minimum sunspot, and during three years of maximum sunspot it operates only in a very minor degree, and in two of those years (namely, the 1st and 2nd) it probably does not operate at all. By thus limiting the period during which the cause operates, a valuable point is gained, and a clue to a knowledge of the cause possibly afforded.

It is also interesting to notice that not only do the rules above indicated obtain *qualitatively*, but that there is also a near approach to a *quantitative* relation between the short period oscillations of the summer and the winter rainfall respectively. The nature of this relation in the years which I have denoted as *positive*, namely, in the 1st, 2nd, and 3rd years of the sunspot cycle, will be seen at once on inspecting the “minor oscillations” curve of the diagram. It will be observed that the oscillation which takes place in the two curves during those three years is not only the same in phase, but is nearly the same in amplitude. The

fact can be expressed numerically by taking the percentage rainfall as given in the "Difference" columns of the above table; when it will be seen that the winter rainfall of the 2nd year was 16·3 heavier than during the 1st and 3rd years taken together; while the summer rainfall was 14·6 heavier. The numbers 16·3 and 14·6, which according to this method are a measure of the excess of the winter and the summer rainfall respectively during the 2nd year, approach each other sufficiently to be noticeable.

The nature of the quantitative relation during the negative years, namely, the 7th, 8th, and 9th, will be best seen by an examination of the actual rainfall of those years. This, obtained from Mr. Hill's Tables I (A and B) and III (A and B), is as follows:—

| Year of the Cycle.          | Winter Rainfall. |         |         | Summer Rainfall. |         |         |
|-----------------------------|------------------|---------|---------|------------------|---------|---------|
|                             | Hills.           | Plains. | Mean.   | Hills.           | Plains. | Mean.   |
|                             | inches.          | inches. | inches. | inches.          | inches. | inches. |
| 1st                         | 17·95            | 6·30    | 12·12   | 41·81            | 26·36   | 34·08   |
| 2nd                         | 9·58             | 3·23    | 6·40    | 54·01            | 34·63   | 44·32   |
| 3rd                         | 16·55            | 4·59    | 10·57   | 47·13            | 27·03   | 37·08   |
| Average of the three years. |                  |         | 9·70    |                  |         | 38·49   |

Dealing only with the mean results, the variations in each year from the three years' average are in the case of the summer and the winter rainfalls respectively as follows:—

|        |           |           |           |
|--------|-----------|-----------|-----------|
|        | 7th year. | 8th year. | 9th year. |
| Winter | + 2·42    | — 3·30    | + 0·87    |
| Summer | — 4·41    | + 5·83    | 1·41      |

Now the point to be noticed is that

$$2·42 : 4·41 :: 3·30 : 5·83 :: 0·87 : 1·41,$$

or very nearly so; the winter figures to be in exact proportion should be 2·53, 3·34, and 0·81; but the approach to exactness is sufficiently near to be striking, and to make one suspect that there has been something more than chance at work in its production. If this proportion can be established as a general rule, it will signify that, during the three years

at, and immediately succeeding, the sunspot minimum, an excess of 1 inch in the winter rainfall is accompanied by a defect of about 1.74 inches in the summer rainfall, and a defect of 1 inch during winter is accompanied by an excess of 1.74 inch during summer.

It is not my intention, for the present at least, to seek out the full meaning of these facts ; indeed, it is scarcely within my province to do so, as the investigation is already in more experienced hands than mine. But the facts forced themselves on my notice, and they seemed of sufficient importance to justify their publication.

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VII.—*Description of a new Lepidopterous Insect belonging to the Heterocerous Genus Trabala.*—By F. MOORE, F. Z. S., A. L. S. Communicated by the NATURAL HISTORY SECRETARY.

(Received August 26th ;—Read December 3rd, 1884.)

TRABALA IRRORATA, n. sp.

♀. Upside dark olivaceous ochreous-yellow, sparsely speckled with dark purple-brown scales, which are most numerously disposed on the exterior border, and sinuously across the inner disc of both wings and also subbasally across the forewing, as well as on the posterior border of the forewing. Both wings with a discal transverse zigzag series of large lilacine-grey spots, which are also thickly speckled with the dark brown scales ; forewing also with the posterior border blotched with lilacine-gray, and with a prominent lilacine-gray spot, with dark brown speckled border, in the middle of the cell. Cilia entirely yellow.

Underside slightly paler than the upperside ; both wings with the discal zigzag spots as above, the exterior borders less sparsely speckled with brown scales ; a slight brown-speckled sinuous discal band also on the hindwing ; cell-spot indistinct.

Body brighter yellow, and tuft lilacine-white.

Expanse  $3\frac{1}{4}$  inches.

HAB. Mergui. Collected by Dr. J. Anderson, F. R. S.

VIII.—*Phyllothelys*, a remarkable Genus of Mantodea from the Oriental Region.—By J. WOOD-MASON, Deputy Superintendent, Indian Museum, Calcutta.

(With Plate XII.)

Genus PHYLLOTHELYS, W.-M.

P. A. S. B. 1876, p. 176.—A. & M. N. II. 1876, 4th ser. vol. xviii, p. 507.—P. E. Soc. 1877, p. xviii.

♂. ♀. Vertex directed forwards and slightly upwards, strongly protuberant between the juxtocular lobes; the protuberance flat and triangular in front, behind convex and trefoil-shaped, being divided into three lobes, one large and median and two small, equal, and lateral; the former produced at the apex into a long, narrow, and very gradually tapering horn, which is expanded, together with the lobes themselves, in the middle line posteriorly and at the sides, into sharp foliaceous crests, and which may be rudimentary in the male; facial shield pentagonal, about as long as broad, marked with two blunt longitudinal ridges, and with its basal angle slightly projecting. Eyes oval, tolerably prominent, not narrowed as in *Phyllocrania*. Pronotum long and slender, nearly five times as long as its parallel-sided anterior lobe, very gradually widening from its narrowest part just behind the dilatation, and equally gradually increasing in height, to its base, close to which it bears a prominent smooth tubercle, and where it is nearly as wide as at the distinct dilatation; prosternum slightly and decreasingly roof-shaped from the insertion of the forelegs backwards. Anterior coxæ, long and slender, when laid back not reaching to the base of prothorax, their apical lobes not divergent, but close together; tibiae half the length of the femora, with only the basal 5 or 6 of the spines of the outer edge curved towards the margin; femora with 3 spines on the outer edge and 4 on the disc; four posterior legs short; femora with genicular spines and with foliaceous lobes on the lower crest; tibiae with their apical half inflated latero-superiorly. Axillary, and anal veins of tegmina running one immediately after the other into the internal ulnar vein, first ulnar vein branched; ulnar vein of wings 2-branched. Abdomen depressed, widening more (♀) or less (♂) from base to end of 5th somite, the remaining somites forming a triangular figure with more or less serrated sides; the dorsal arc of its 10th somite roof-shaped, broader than long, subtriangular.

This interesting and curious form may be provisionally placed between the African genus *Phyllocrania* and the Oriental genus *Anazarcha*.

1. *PHYLLOTHELYS WESTWOODI*, W.-M., Pl. XII, Figs. 1—2.

loc. supra cit.

♂.♀. Rich dark or light umber-brown of the colour of bark and dead and rotten leaves.

♀. Vertex greatly protuberant; the protuberance divided into three lobes, two small and hemispherical, lateral and basal, and one large, the median lobe of the vertex, flat, smooth, and triangular in front, but convex in every direction behind, and rounded at the apex, from which it suddenly gives off a long, slender, and very gradually tapering almost linear horn; the protuberance is marked off in front from the rest of the head by a transverse groove which corresponds to an imaginary straight line drawn tangentially to the upper surface of the eyes, and the sides of its median lobe and of the horn into which this is prolonged are expanded into foliaceous crests, which are turned up or rather back at their outer edges and, being longitudinally wrinkled on their anterior surface, are hence sharply marked off from the perfectly smooth primitive horn; this is raised, in the middle line of its posterior face, into a thin, sharp, and prominent crest, which is continued a short distance on to the protuberance itself, and, owing to the forward curvature of the horn, as well as to its own decrease in height from the base upwards, hence has its free edge distinctly arched. In the male, the horn and its parts are reduced to a quite rudimentary condition and are folded up into a soft, flexible, and slightly asymmetrical conical process only about 1 millim. in length. Facial shield pentagonal, fully as long as broad, with two distant and incomplete longitudinal ridges on its disc and a blunt spiniform tubercle projecting from its basal angle. Eyes rather prominent; not nearly so narrow as in *Phyllocrania*.

Prothorax greatly elongated and slender, devoid of all traces of foliaceous expansions; prosternum roof-shaped decreasingly from the setting-on of the forelegs backwards and thickly speckled with darker; pronotum narrowing behind the dilatation and then widening again, concomitantly increasing in height, to the base, where it is as broad as at the dilatation, and where it bears in the middle line an elongate and slightly bilobed smooth tubercle; with its lateral margins finely denticulate and with a well-developed supracoxal dilatation; its anterior lobe parallel-sided, with a median dorsal ridge lodged in a shallow depression; its posterior lobe provided with a raised median longitudinal ridge decreasing from the base forwards and becoming stronger again, at the dilatation, where, like the ridge on the anterior lobe with which it is in unbroken continuity, it is lodged in a shallow depression.

The forelegs are long and slender. The coxæ are triquetrous and when laid back do not reach to the base of the prothorax; their inner face is coloured red-violet surmounted on the upper crest by yellowish marked with 10—13 minute elongate black spots lying at the bases of as many minute black spinules, between which are some very much more minute yellowish ones. The femora are very slightly sinuous above, but arched below; their outer face bears one distinct oblique bar and a minute mottling of a darker shade of brown than the ground-colour; their inner face is black, with the apex, a complete transverse bar nearer to the ungual groove than to the apex, and an oblong mark nearly midway between the ungual groove and the base on the upper half, all yellow; tibiæ jet-black internally and below, armed on the inner edge with 14—15 and on the outer edge with 16 teeth, the basal five only of which are more recumbent than the rest and even they do not nearly touch the margin, or even one another; the intermediate and posterior legs are short; they are ridged as in *Phyllocrania*; the posterior of their lower crests bears a foliaceous lobe divided by an emargination into a very small proximal and a much larger distal portion with a rounded and nearly entire margin; the tibiæ have no foliaceous crests, but, in lieu thereof, the proximal half swollen and thickened club-like laterodorsally, as in one or both of the same pairs of legs in the species of the tropical American genus *Acanthops* and its allies.

Organs of flight extending very little beyond the extremity of the abdomen, coloured. Tegmina coriaceous, opaque umber-brown anteriorly, posteriorly membranous and hyaline covered irregularly with brown-smoky spots, which tend in places to coalesce so as to form a coarse mottling; anal gusset reticulate, with the membranous meshes smoky and the net-work obsoletely lined with hyaline; the stigma elongate, polished. Wings with the anterior margin semiopaque umber-brown, the apex of the anterior area distinctly brown-spotted like the corresponding part of the tegmina; all the rest of the organs brown smoky-quartz-coloured, gradually increasing in intensity from the base to the outer margin, and tolerably distinctly lined with hyaline on both sides of the transverse veinlets.

Abdomen broad and depressed, gradually widening from its base to the end of the 4th somite, whence it widens with greater rapidity to the end of the 5th, the posterior angles of which are produced outwards; the rest of the abdomen forming a triangular mass the sides of which are slightly jagged owing to the production of the posterior angles of the dorsal arcs of the 6th and 7th somites; the terminal dorsal arc is crescent-shaped, longitudinally roof-shaped, and more than twice as broad as long.

The cerci are of the ordinary slender conical form and do not reach so far as the end of the ovipositor.

♂. Smaller and slenderer with the cephalic horn and its crests, as has been already stated, reduced to a rudimentary condition and all folded or shrivelled up together so as to form a soft and flexible projection no more than about a millimetre in length.

Organs of flight almost wholly membranous and hyaline. Tegmina with the marginal field semiopaque brown resolved into spots at the apex, with a few scattered groups of arcolelets in the discoidal area and the meshes of the anal gusset faintly smoky, and with some dark brown linear dashes on the longitudinal veins. Wings with their anterior margin pale brown spotted at the apex, the rest of these organs being very faintly iridescent-smoky, with obsolete double hyaline edgings to the transverse violets, from the base nearly to the outer margin, along which the smokiness and the longitudinal veins are alike darker, especially in the anterior area.

In the Tenasserim specimen of this sex the cephalic protuberance is more broadly rounded at the top and less produced, and the horn is more rudimentary. ( ? in consequence of the specimen being a dried one), but there is no other apparent difference between it and the spirit-specimen from Assam described above, except perhaps in the joint (exaggerated in fig. 1) of the wings, which is slightly deeper in the latter.

Total length, ♀ 51, ♂ 40; height of head, from free margin of labrum to apex of horn, ♀ 14, ♂ 4·5, breadth of head between the eyes, ♀ 4·5, ♂ 3·75, length of horn, from a straight line drawn tangentially to the upper surface of the eyes, ♀ 10, ♂ 1·5; length of antennæ, ♀ 22, ♂ 22; length of pronotum, ♀ 22, ♂ 14·5, of its anterior lobe, ♀ 5, ♂ 3·3, of its posterior lobe, ♀ 17, ♂ 11·2, breadth of pronotum at supra-coxal dilatation, ♀ 3·5, ♂ 2·75; length of fore-coxa ♀ 13, ♂ 9; femur, ♀ 14·5, ♂ 10, tibia, ♀ 8, ♂ 5·5, intermediate femur, ♀ 5·5, ♂ 4·5, tibia, ♀ 5, ♂ 4, posterior femur ♀ 7·5, ♂ 6, tibia ♀ 7, ♂ 5·5; length of tegmina ♀ 27, ♂ 27, breadth across middle ♀ 6·5, ♂ 6 millims.

HAB.—2 ♀ and 1 ♀ nymph, Sibságar, Assam (*S. E. Peal*), 1 ♂, Buxa, Bhutan (*Dr. Lewis Cameron*), and 1 ♂ Moolai, Upper Tenasserim (*Moti Ram*) in Indian Museum, Calcutta. A fine female is preserved in the British (Natural History) Museum, South Kensington, London.

## 2. *PHYLLOTHELYS PARADOXUM*, n. sp., Pl. XII, Fig. 3.

♂ nymph. Nearly allied to the preceding, which it closely resembles in the relative proportions of its parts and in every detail of colour and ornamentation, but from the same sex of which it differs in the possession of a fully developed cephalic horn and from the opposite sex



in the form of this horn, which is slenderer, much more thinly foliaceous, and jagged, instead of entire, on the edges, so as to resemble a very narrow pinnately-cleft leaf, the mid and lateral ribs of which are represented by the thick and hence, opaque axes of the horn and its lateral processes. The fore tibiae have 16 teeth on the outer edge and 14 on the inner.

The only measurements of this immature insect that can usefully be given are :—length of pronotum 11, of fore femur 7, height of head, from free edge of labrum to top of horn, 7 millins.

HAB. Burmah.

This interesting animal was presented to me many years ago by my friend Mr. William Theobald of the Geological Survey of India.

#### EXPLANATION OF PLATE XII.

Fig. 1. *Phyllothelys westwoodi*, W.-M., ♂, with wings extended, nat. size; 1 a. the head, viewed from in front,  $\times 2$ ; 1 b. the left fore-leg, from the inside,  $\times 2$ .

Fig. 2. *Phyllothelys westwoodi*, ♀, with wings extended, nat. size; 2 a. the head, from behind,  $\times 2$ ; 2 b. the same, from in front,  $\times 2$ ; 2 c. the end of the abdomen, from above,  $\times 2$ ; 2 d. the posterior leg of right side, from in front,  $\times 2$ .

Fig. 3. *Phyllothelys paradoxum*, n. sp., ♂ nymph, the head, from in front,

#### IX.—*Notes on Indian Rhynchota*, No. 1.—By E. T. ATKINSON, B. A.

Unless where expressly stated to be descriptions, the notes attached to each species are merely intended as aids to identification; and the measurements of specimens not in the Indian Museum have been converted into millimetres from the measurements of the several authors.

#### HOMOPTERA.

Family CICAIDÆ, Westwood, *Introd. Mod. Class. Ins.* ii, 420 (1840).

*Stridulantia*, Stål, *Hem. Afric.* iv, p. 1 (1866).

Ocelli three, placed on the disc of the vertex. Pronotum and mesonotum very large. Anterior coxæ prismatic, oblong, inserted in the anterior angles of the prostethium: intermediate and posterior coxæ briefly subconical, somewhat contiguous, remote from the sides of the body. Anterior femora incrassated, very often spinose, tibiae smooth. Tarsi 2—3 jointed. Abdomen in the males with an organ of sound on each side at the base.

## Genus POLYNEURA, Westwood.

Westwood, Arc. Ent. i, p. 92 (1842): Am. et Serv., Hist. Nat. Hém. p. 460 (1843); Stål, Hem. Afric. iv, p. 3 (1866).

## 1. POLYNEURA DUCALIS.

*Polyneura ducalis*, Westwood, Arc. Ent. i, p. 92, t. 24, f. 2 (1842); Jardine, Nat. Lib. t. 18, f. 1 (1843); Am. et Serv., Hist. Nat. Ins. Hém. p. 460 (1843); Walker, List. Hom. B. M., i, p. 2 (1850).

Easily recognised by its rich golden brown colour and the apical half of the tegmina being finely reticulated with hexagonal cells. Body long 35; exp. teg. 102 millims.

Reported from Assam, Sikkim, Nepal. The Indian Museum possesses specimens from Sikkim and Assam.

## Genus PÆCULOPSALTRIA, Stål.

Hem. Afric, iv, p. 2, (1866); Berl. Ent. Zeitschr. p. 168 (1866).

Allied to *Tettigades*, Am. et Serv. Thorax angulated on each side, anterior femora not spinose, metasternum elevated, the elevated part sulcate, produced and subsinuato-truncated in front.

## 2. PÆCULOPSALTRIA AFFINIS.

*Tettigonia affinis*, Fabr., Syst. Rhyn. p. 37 (1803).

*Cicada affinis*, Germar in Thon's Archiv. Ent. ii, fasc. 2, p. 1, G, (1830), in Silbermann's Rev. Ent. ii, p. 79 (1834); Walker, List Hom. B. M. i, p. 3 (1850).

*Pæculopsaltria affinis*, Stål, Hem. Fabric. ii, p. 4 (1869).

Body long 23; exp. teg. 77 millims.

Reported from India, but no specimens appear in the British Museum list, and it would be well again to identify the locality of the specimen noted in Mus. Lund.

## Genus PLATYPLEURA, Amyot &amp; Serville.

Amyot et Serville, Hist. Nat. Ins. Hém. p. 465 (1843); Stål, Hem. Afric. iv, p. 2 (1866); Butler, Cist. Ent. i, p. 184 (1874).

(a.) *Species with yellow or tawny wings.*

## 3. PLATYPLEURA PHALÆNOIDES.

*Platyleura phalænoides*, Walker, List Hom. B. M. i, p. 4 (1850); Butler, Cist. Ent. p. 185 (1874).

*Platyleura interna*, Walker, l. c. iv, p. 1119 (1852), which differs in having the anal angle only (instead of the whole flap) of the wings black.

*Platyleura congress*, Stål, MS., is also possibly only a variety of this species.

Reported from Bengal, Assam, Silhat, N. India. A somewhat common species in Sikkim. The Indian Museum possesses specimens from Sibságar, Sikkim, and Darjiling.

An examination of some fifty males shows some variations in individuals, even amongst those collected in the same locality. In the hyaline apical portion of the tegmina, the brown band is sometimes connected with the marginal row of spots, sometimes with the brown band across the middle part of the tegmina, and sometimes with neither. The hyaline spots in the radial and 3—4 ulnar areas vary much in size, and the metathoracic markings vary in size and distinctness. The venation, too, is not altogether uniform, and the colour of the thorax varies from green to brown.

♀. Body sordidly luteous above and below. Face moderately convex, transversely sulcated, with a longitudinal groove, luteous, vertex and pronotum furrowed, luteous. The mesonotal marks are represented by two almost obsolete short black lines on fore border and two faint black dots on hinder border. Abdomen black above, first three segments marginally luteous-pubescent; below, central portion tawny, thickly pubescent. Opercula small, somewhat rounded, wide apart. Legs concolorous with body: posterior tibiæ spinose, tarsi and claws piceous. Tegmina, markings as in ♂, but basal half suffused with deep fulvous. Wings as in ♂, but apical third alone brown, limbus hyaline, flaps fulvous. Length body,  $22\frac{1}{2}$ ; exp. tegm. 75; of one tegmen 34; breadth of pronotum 13 millims.

HAB. Sikkim, one specimen only in the Indian Museum.

#### 4. *PLATYPLEURA ASSAMENSIS*, n. sp.

Sordid green, face very slightly convex, transversely sulcated, with a longitudinal groove: a fascia extending from eye to eye through the base of the antennæ, black. Rostrum extends to third abdominal segment, tip piceous. Markings above as in *P. phalaenoides*, Walker. Abdomen piceous, each abdominal segment with a slight marginal fulvous pubescence. Opercula very small, wide apart piceous in the ♀; close together, piceous and margined with slight tawny in the ♂. Basal half of tegmina, brown, with irregular pale markings: a hyaline spot in the third quarter of the radial area, a pale spot at the base of the radial area and the 4—5 ulnar areas. Apical half of the tegmina pale hyaline; a brown patch extending through the apical anastomoses of the 1—3 ulnar areas: an inner apical row of six brown spots, first two and last broadest, first two confluent, middle sagittate, last confluent with the dot on the limbus: apical veins ending in six small oblong brown spots, beyond which in the limbus are six minute dots. Wings marked as in *P. phalaenoides* with which it is closely allied, but the body is much less robust, and smaller; and there is a difference in the markings and colour of the tegmina. Length body,  $23\frac{1}{2}$ ; exp. tegm., 69; of single tegmen, 30; breadth of the pronotum 12, millims.

♂ is slightly smaller, tegmen, 27 millims.

HAB. Sibságar and Nága Hills: ♂ and ♀ in Indian Museum.

#### 5. PLATYPLEURA NICOBARICA, n. sp.

Light ochraceous, shining. Face moderately convex, transversely sulcated, with a median longitudinal groove, an interrupted fascia extending from eye to eye, and a patch on each side of the base of the rostrum and along the first joint thereof, black. The rostrum extends well beyond the posterior coxæ, tip black. Eyes dull castaneous, pilose behind. Vertex deeply grooved, the hollows, a small triangular patch below the ocelli, a narrow fascia from eye to eye through the ocelli, and a narrow short longitudinal line between the ocelli and eyes, black. Pronotum furrowed, with a single, longitudinal, narrow, short, black line in the middle of the anterior margin, lateral processes subtriangular and their external margins brown. The mesonotum with two triangular black spots, their bases resting on the anterior margin, and on each side a large distinct V-shaped mark, slightly interrupted on the inner side, and two small round spots near the posterior margin. Segments of abdomen black, margined with yellow, above and below, slightly pubescent. Legs ochraceous, extremities of tibiæ and claws brown-black, posterior tibiæ spinose. Opercula ochraceous, small, rounded, contiguous, having a black patch near the base of posterior coxæ. Tegmina, basal half tawny with irregular brown markings in the radial and 1—4 ulnar areas and one in the costal membrane. The upper third of the third ulnar area and the apical areas hyaline, with an almost obsolete series of minute dots at the end of each vein: wings ochraceous, apical third brown, with veins ochraceous, a discal streak to anal angle and two lines confluent at the inner angle, brown. Length body, 24: exp. tegmina,  $75\frac{1}{2}$  of single tegmen 33: breadth of the pronotum,  $14\frac{1}{2}$  millims.

HAB. Nicobar Islands: in Indian Museum.

#### 6. PLATYPLEURA SPHINX.

*Platypleura sphinx*, Walker, List. Hom. B. M. i, p. 13 (1850): Butler, Cist. Ent. p. 188 (1874).

Tegmina whitish, brownish-tawny towards the base and having elsewhere some irregular pale-brown marks which here and there include white spots. Body long 18; exp. teg. 43 millims.

Reported from N. Bengal, N. India.

#### 7. PLATYPLEURA CÆLEBS.

*Platypleura cælebs*, Stål, Trans. Ent. Soc. 3rd Ser. i, p. 573 (1863): Butler, Cist. Ent. p. 188 (1874).

Allied to *Pæcilopsaltria capitata*, Olivier, (Enc. Méth. v, p. 754) in regard to size, broadness of apical limbus, tegmina and wings. Body long 23: exp. teg. 68 millims. Reported from N. India.

#### 8. PLATYPLEURA ANDAMANA.

*Platypleura andamana*, Distant, Trans. Ent. Soc. p. 174 (1878).

This species was described from a specimen procured from the Andaman islands. Body long 22: exp. teg. 84 millims.

#### 9. PLATYPLEURA ROEPSTORFFII, n. sp.

♂. ♀. Brownish tawny. Face gamboge colour, moderately convex, transversely sulcated, with a brown longitudinal groove. Rostrum extending almost to the posterior margin of the first abdominal segment, tip brown. Legs brown above, tawny below; tibiae setose, posterior pair spinose. Eyes bright castaneous, moderately prominent, pilose behind. Second joint of antennæ pale tawny. A fascia from eye to eye, through the base of the antennæ and frons, and another through the ocelli, black. Pronotum grooved, with an obtuse-angled black mark on middle of posterior border; lateral processes subtriangular, anterior margin slightly brown. Mesonotum with two obconical spots extending backwards from anterior border and having between them a variable sagittate mark, two dots wide apart, near posterior border, and a very obscure mark situated on the outer side of each of the obconical spots, black. Abdominal sutures black, margined with luteous, pubescent; anal segment below, luteous. Opercula very small, subelliptical, wide apart in the ♂; contiguous, semi-rounded, in the ♀. Tegmina brown, opaque: basal third tinged with tawny, very apparent when stretched out; two spots in the radial area (the basal extending into the costal membrane) and one in the fourth ulnar area, black. A patch in the middle of the first ulnar area, extending into the third, and one near the base of the third ulnar area, extending into the fourth, pale brown. Apical area pale brown; veins adorned with oval marks, brown, with a centre of pale brown. External margin with a row of six subquadrangular brown spots, divided by oval pale brown spots. Wings fulvous tawny, disc and a band along the fore and external borders brown. Length of body,  $24\frac{1}{2}$ ; exp. tegm.  $76\frac{1}{2}$ ; of one tegmen, 34; breadth of pronotum, 12 millims.

Closely allied to *P. andamana*, Distant.

HAB. Andaman Islands. Several specimens are in the Indian Museum.

(b). With black and white wings.

#### 10. PLATYPLEURA BASIALBA.

*Oxypleura basialba*, Walker, List Hom. B. M. i, p. 26, (1850).

*Platypleura basialba*, Butler, Cist. Ent. i, p. 191 (1874).

Body long 19, exp. teg. 61 millims. Reported from N. Bengal.

## 11. PLATYPLEURA NOBILIS.

*Cicada nobilis*, Germar in Thon's Archiv. ii, fasc. 2, p. 9 (1830); in Silbermann's Rev. Ent. ii, pt. 2, p. 82, (1834).

*Cicada hemiptera*, Guérin, Voyage Bélanger Ind. Orient. p. 500 (1834).

*Platypleura semilucida*, Walker, List Hom. B. M. i. p. 20 (1850).

*Platypleura nobilis*, Butler, Cist. Ent. i, p. 191 (1874); Distant, J. A. S. B. xlviii, (2), p. 38 (1879).

Reported from Java, Singapore, and Tenasserim: there is a specimen in the Indian Museum from Tenasserim. As this is a typical species of the smaller members of this genus, I re-describe it, the original description being practically unobtainable.

Tawny. Face tawny, moderately convex, transversely sulcated with the furrows brown and a longitudinal groove broadly black. Rostrum extending to the fourth abdominal segment, tip piceous. Eyes dull castaneous, with a narrow black fascia, extending from anterior margin around the base of the antennæ. Vertex with a bright tawny fascia on anterior margin and two minute obconical black marks, extending from posterior margin on each side of the ocelli, obsolete in some. Pronotum tawny, furrowed, furrows black; a line from the middle of the anterior border to the posterior border, black and quadrangularly expanded on the disc. Mesonotum fulvous brown, with two moderate obconical black spots, extending backward from the fore border, midway between which there is a discal line connected with a fascia on the hinder border also black. On the outer side of both the moderate obconical spots is a large obconical patch, black, and extending from the fore border almost to the hind border. The metanotum is bright tawny. The abdominal sutures are black, edged with fulvous, slightly pubescent. Below, the fulvous margins of the abdominal segments alone appear. Opercula tawny, brown at the base, rounded, small, wide apart. Legs tawny, anterior and middle femora spotted brown, posterior tibiæ spinose. Tegmina, basal third tawny, with some irregular lighter markings: a hyaline spot, at the apex of the radial area, just above a dark brown spot which extends into the costal membrane: a black spot in the ulnar space. Apical two-thirds of tegmina hyaline, with three minute brown spots on the apical anastomoses of the first and second ulnar areas, also a very minute brown spot on each side of the middle of the vein separating the second from the third apical area and the third from the fourth; six minute brown spots on the limbus. Basal two-thirds of the wings brown, with a discal streak extending to the anal angle, tawny; apical third, hyaline; flaps tawny with a brown line on the suture. Length body 16; exp. tog. 46; length of one tegmen 24; breadth of pronotum 8 millims.

Variety, *a*.—Markings on face and pronotum more distinctly black. The markings on the basal third of the tegmina are more distinctly pale forming a band of five spots extending from the costal membrane through the ulnar areas. The brown spots in the hyaline apical portion broader, the internal apical row produced through the apical areas and the external apical row of dots duplicated. The tawny discal streak of the wings wanting, flaps grey hyaline. From Manipur, in Indian Museum. Allied to *Platypheura insignis*, Distant.

## 12. PLATYPLEURA INSIGNIS.

*Platypheura insignis*, Distant, J. A. S. B. xlviii (2), p. 39, t. 2, f., 2 (1879).

Allied to the preceding, but tegmina and wings very distinct, the opaque portion being much less than in that species. Body long 15; exp. teg. 45 millims. Reported from Terasserim and Hindustan: a specimen from the former locality is in the Indian Museum.

(c.) *With black, white, and red wings.*

## 13. PLATYPLEURA OCTOGUTTATA.

*Tettigonia octoguttata*, Fabricius, Ent. Syst. Suppl. p. 515 (1798); Syst. Rhynch. p. 39 (1803); Coquebert, Ill. Ins. i, p. 34, t. 9, f., 1 (1790).

*Oxypleura sanguiflua*, Walker, List Hom. B. M. i., p. 24 (1850); Ins. Saund. Hom. p. 2 (1858).

*Pecilocsaltria octoguttata*, Stål, Berl. Ent. Zeitschr. x, p. 168 (1866) (re-described).

*Platypheura octoguttata*, Butler, Cist. Ent. i, p. 192 (1874).

Body long 27; exp. teg. 80 millims. Reported from the Panjab, N. India, N. Bengal, S. India. The Indian Museum possesses specimens from Bengal, Calcutta, and Sambhalpur in the Central Provinces.

## 14. PLATYPLEURA SUBRUFa.

*Oxypleura subrufa*, Walker, List Hom. B. M. i, p. 25 (1850).

*Pecilocsaltria capitata*, Stål, Berl. Ent., Zeitschr. x, p. 169 (1866), who joins together 'subrufa' and 'capitata' Olivier (Enc. Méth. v, p. 754, t. 112, f. 10), the former an Indian and the latter a Ceylon species. They have been separated again by Butler (Cist. Ent. i, p. 192) and should remain separate.

*Platypheura subrufa*, Butler, Cist. Ent. i, p. 192 (1874).

Body long 27; exp. teg. 75 millims. Reported from Coromandel and India.

(d.), *With black, white, and brown wings.*

## 15. PLATYPLEURA BUFO.

*Oxypleura bufo*, Walker, List Hom. B. M. i. p. 27 (1850).

*Platypheura bufo*, Butler, Cist. Ent. i, p. 195 (1874).

Body long 25; exp. teg. 81 millims. Reported from India.

## 16. PLATYPLEURA CERVINA.

*Platypleura cervina*, Walker, List Hom. B. M. i, p. 16 (1850) ♀; Butler, Cist. Ent. i, p. 198 (1874).

*Platypleura straminea*, Walker, l. c. p. 17, ♂.

Body long 17: exp. teg. 50 millims. Reported from N. Bengal.

## Genus TACUA, Amyot &amp; Serville.

Am. & Serv., Hist. Nat. Ins. Hém., p. 461 (1843): Stål, Hem. Afric. iv, p. 3. (1866).

## 17. TACUA SPECIOSA.

*Tettigonia speciosa*, Illiger in Wied. Zool. Arch. ii, 145, t. 2; Fabricius, Syst. Rhyn. i, p. 33 (1803).

*Cicula in lica*, Donovan, Ins. Ind. Hem., t. 2, f. 3, (1800).

*Cicula speciosa*, Blanchard, Hist. Nat. Ins. iii, 165; Hém. t. 9 (1840-41).

*Tacua speciosa*, Am. et Serv., Hist. Nat. Ins. Hém. p. 462 (1843); Walker, List Hom. B. M. i, p. 46 (1850). J. A. S. Zool. i, p. 141 (1857).

Body long 55 millims. Reported from Java, Bengal (Donovan).

## Genus TOSENA, Amyot &amp; Serville.

Am. & Serv., Hist. Nat. Ins. Hém. p. 462 (1843): Stål, Hem. Afric. iv, p. 3. (1866).

## 18. TOSENA MELANOPTERA.

*Tosena melanoptera*, White, A. & M. N. H. xvii, p. 331 (1846); Walker, List Hom. B. M. i, p. 46 (1850).

Body long 60: exp. teg. 142 millims. Reported from Silhat, N. India. The Indian Museum possesses specimens from Sibságar and Sikkim.

## 19. TOSENA MEARESIANA.

*Cicula mearesiana*, Westwood, Arc. Ent. i, p. 98, t. 25, f. 1 (1842).

*Tosena mearesiana*, Am. & Serv., Hist. Nat. Ins. Hém. p. 463 (1843); Walker, List Hom. B. M. i, p. 46 (1850).

Body long 44: exp. teg. 130 millims. Reported from N. India. The Indian Museum possesses specimens from Sikkim.

## 20. TOSENA ALBATA.

*Tosena albata*, Distant, Trans. Ent. Soc. Lond. 1878, p. 175.

Body long 59: exp. teg. 132 millims. Reported from N. India.

## 21. TOSENA SPLENDIDA.

*Tosena splendida*, Distant, Ent. Month. Mag. xv, p. 76 (1878).

♂. Body long 47: exp. teg. 124 millims. ♀. Body long 49: exp. teg. 127. Reported from Assam, Nága Hills, Khasiya Hills. The Indian Museum possesses ♂ and ♀ from the Lushai country.



## Genus HUECHYS, Amyot &amp; Serville.

Am. & Serv., Hist. Nat. Ins. Hém. p. 464 (1843); Stål, Hem. Afric. iv, p. 4 (1866).

## 22. HUECHYS PHILÆMATA.

*Tettigonia philæmata*, Fabricius, Syst. Rhyn. p. 42 (1803); Stoll, Cig. p. 53, t. 13, f. 62 (1788).

*Cicada philæmata*, Germar in Thon's Archiv. ii, fasc. 2, p. 26 (1830); in Silbermann's Rev. Ent. ii, p. 75, n. 52 (1834); Burmeister, Handb. Ent. ii, (i) p. 180 (1835).

*Cicada sanguinea*, Guérin, Voyage La Favorite, v, p. 155 (1839); Mag. Zool. p. 75 (1839).

*Huechys philæmata*, Am. & Serv., Hist. Nat. Ins. Hém. p. 465 (1843); Walker, List Hom. B. M. i. p. 251 (1850).

Guérin (l. c.) unites this species with the following and keeps *H. sanguinolenta*, Fabr., which he had not seen, distinct, but he is not followed in this arrangement by later writers.

Body above black with the frons, two quadrate patches on mesothorax, and abdomen sanguineous: tegmina brown, wings cindery-grey and subhyaline. Body long 22 millims.

Reported from Philippine Islands, N. Bengal, and Silhat. The Indian Museum possesses specimens from the Nāga Hills, N. India, and Tenasserim.

## 23. HUECHYS SANGUINEA.

*Cicada sanguinea*, De Géer, Ins. iii, 221, t. 33, f. 17 (1773); Gmelin Ed. Syst. Nat. i, 3, 2098 (1782); Westwood in Donovan's Ins. China, t. 16, f. 1 (1842).

*Tettigonia sanguinolenta*, Fabricius, Syst. Ent. p. 681 (1775); Spec. Ins. ii, p. 321 (1781); Mant. Ins. ii, p. 267 (1787); Ent. Syst. iv, p. 25 (1794); Syst. Rhyn. p. 42 (1803).

*Cicada sanguinolenta*, Olivier, Enc. Méth. v, p. 756 (1790); Germar in Thon's Archiv, ii, fasc. 2, p. 3 (1830), in Silbermann's Rev. Ent. ii, p. 75 (1834); Blanchard, Hist. Nat. Ins. iii, p. 165 (1840-41); Guérin, Voyage La Favorite, v, p. 155, t. 45, f. 1 (1839); Mag. Zool. p. 76, t. 237, f. 1 (1839).

*Huechys sanguinea*, Am. & Serv., Hist. Nat. Ins. Hém. p. 465 (1843); Walker, List Hom. B. M. i, p. 251 (1850); J. L. S. Zool. i, p. 84 (1856); *ibid.*, x, p. 95 (1867); Distant, J. A. S. B. xlviii, (2) p. 38 (1879).

Guérin separates '*sanguinolenta*, Fabricius' and unites '*philæmata*' with '*sanguinea*'. *H. incarnata*, Germar, Silb. Rev. Ent. ii, p. 75, (1834), and Brullé Hist. Nat. Ins. Hém. ii, t. 3, f. 2, is probably only a variety of *H. sanguinea*.

Head, thorax, and feet black: frons, two great spots on the mesothorax, and abdomen sanguineous: tegmina black: wings fuscous. Body long 18; exp. teg.  $41\frac{1}{2}$  millims.

Reported from India, Singapore, China, and the Eastern Archipelago. Specimens exist in the Indian Museum from Sikkim, Sibságar, Calcutta, and Tenasserim.

## 24. HUECHYS TESTACEA.

*Tettigonia testacea*, Fabricius, Mant. Ins. ii p. 267 (1787); Ent. Syst. iv, p. 24 (1794); Syst. Rhyn. p. 42 (1803); Stoll, Cig. p. 41, t. 8, f. 41 (1788).

*Cicada testacea*, Gmelin Ed. Syst. Nat. i, pt. 4, p. 2098 (1782); Olivier, Enc. Méth. v, p. 756, t. 113, f. 5 (1790); Germar in Thon's Archiv. ii, fasc. 2, p. 3, (1830); Guérin, Voyage La Favorite, v, p. 155 (1839); Mag. Zool. p. 78 (1839).

*Huechys testacea*, Walker, List Hom. B. M. i, p. 252 (1850).

The upper surface of the body without red marks: tegmina brown, only partly transparent: wings concolorous, veins black: abdomen sanguineous.

Reported from Coromandel.

## 25. HUECHYS PHANICURA.

*Cicada phanicura*, Germar in Silbermann's Rev. Ent. ii, p. 76 (1834); Guérin, Icon. du Règne Animal, p. 78 (1830-34).

*Huechys phanicura*, Walker, List Hom. B. M. i, p. 252 (1850).

Black, entire frons, mesothorax, and abdomen sanguineous; tegmina and wings black; sometimes frons black in the middle and thorax with a black basal spot or band running through it, sides and small median spot red.

Reported from India, Sikkim.

## 26. HUECHYS TRANSVERSA.

*Huechys transversa*, Walker, List Hom. B. M. Suppl. p. 40 (1858).

Black: tegmina with costa and transverse veins red and a testaceous band. Body long 23: exp. teg. 62 millims.

Reported from Hindustan.

## 27. HUECHYS THORACICA.

*Huechys thoracia*, Distant, J. A. S. B. xlviii, (2), p. 39, t. II, f. 3 (1879).

Known by the red hour-glass-shaped fascia on pronotum. Body long 19: exp. teg. 43 millims.

Reported from Tenasserim and Hindustan.

## 28. HUECHYS TRABEATA.

*Cicada trabeata*, Germar in Thon's Archiv, ii, fasc. 2, p. 3 (1830); Guérin, Mag. Zool. p. 78 (1839).

*Huechys trabeata*, Walker, List Hom. B. M. i, p. 252 (1850).

Body ferruginous, tegmina and wings fuscous with ferruginous veins. Body long,  $20\frac{1}{2}$  millims; tegmina broken at the ends.

Reported from Java.

There is a specimen in the Indian Museum, locality unknown.

## Genus SCIEROPTERA, Stål.

Hem. Afric. iv, p. 4 (1866).

Allied to *Gaena*: ulnar veins contiguous at the base or united for a short distance; head scarcely narrower than the base of the thorax; anterior femora incrassated, spinose beneath.

## 29. SCIEROPTERA CROCEA.

*Cicada crocea*, Guérin in Voyage La Favorite, v, p. 159, t. 45, f. 3 (1829); Mag. Zool. p. 79, cl. ix, t. 237, f. 3 (1839); in Voyage La Coquille, Zool. ii (2), p. 182 (1830).

*Huechys crocea*, Walker, List Hom. B. M. i, p. 252 (1850).

*Scieroptera crocea*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866).

Yellow: thorax above with four reddish brown spots: abdomen saffron-red, more obsolete below. Feet yellow, tibiae and tarsi black. Tegmina and wings hyaline with yellow veins.

Reported from Bengal.

## 30. SCIEROPTERA SPLENDIDULA.

*Tettigonic splendidula*, Fabricius, Syst. Ent. p. 681 (1774); Spec. Ins. ii, p. 321 (1781); Mant. Ins. ii, p. 267 (1787); Ent. Syst. iv, p. 25 (1794); Syst. Rhyn. p. 42 (1803).

*Cicada splendidula*, Gmelin Ed. Syst. Nat. i, pt. 4, p. 2098 (1782); Olivier, Enc. Méth., v, p. 756 (1790); Germar in Thon's Archiv, ii, fasc. 2, p. 45 (1830); Guérin, in Voyage La Favorite, v, p. 159 (1839); Mag. Zool. p. 79 (1839); Westwood in Donovan's Insects China, t. 16, f. 4 (1842).

*Huechys splendidula*, Walker, List Hom. B. M. i, p. 252 (1850).

*Scieroptera splendidula*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866); Distant, J. A. S. B. xlviii (2), p. 38 (1879).

Yellow; thorax above with four large blackish rounded spots. Tegmina golden brown: anterior tibiae red, femora black: posterior femora red: abdomen sanguineous. Body long 17: length of one teg. 19½ millims.

Reported from N. India, Silhat, Tenasserim. The Indian Museum possesses specimens from Tenasserim, Arakan, and the Khasiya Hills.

## 31. SCIEROPTERA FUMIGATA.

*Huechys fumigata*, Stål, Öfvers. Kong. Vet. Akad. Förh. p. 244 (1854); Walker, List Hom. B. M. Suppt. p. 314 (1858).

*Scieroptera fumigata*, Stål, Berl. Ent. Zeitschr. x, p. 169 (1866).

Head, thorax, and scutellum black; their lateral margins, a median patch on the thorax, and spot on the scutellum yellow: tegmina fuscovineous, costa and veins weakly yellow testaceous; wings weakly vineous hyaline, abdomen and femora testaceous, the former above blackish. Body long 12: exp. teg. 28 millims.

Reported from India.

## Genus GRAPTOTETTIX, Stål.

Hem. Afric. iv, p. 4 (1866).

Allied to *Gæana*: tegmina with ten apical cells: vertex twice as wide as the eyes: anterior femora spinose beneath; tibiæ longer than femora.

## 32. GRAPTOTETTIX GUTTATUS.

*Graptotettix guttatus*, Stål, Berl. Ent. Zeitschr. x, p. 170 (1866).

Blackish with the frons, four oval spots on the thorax, two large spots on the scutellum, and the abdomen sordidly yellow: tegmina and wings fuscous. Body long 25: exp. teg. 67 millims.

Reported from the Himálaya. The Indian Museum has a specimen from Sikkim.

## Genus GÆANA, Amyot &amp; Serville.

Hist. Nat. Ins. Hém. p. 463 (1843).

## 33. GÆANA OCTONOTATA.

*Cicada octonotata*, Westwood, Arc. Ent. ii, p. 34, t. 57, f. 2, ♀ (1843).

*Huechys octonotata*, Walker, List Hom. B. M. i, p. 253 (1850).

Easily recognised by the tegmina brown with four yellowish spots and the wings roseate. Body long 37: exp. teg. 61 millims.

Reported from Assam. The Indian Museum possesses specimens from Sikkim.

## 34. GÆANA DIVES.

*Tosena dives*, Westwood, Arc. Ent. i, p. 98, t. 25, f. 2 (1842): Am. et Serv. Hist. Nat. Ins. Hém. p. 464 (1843): Walker, List Hom. B. M. i, p. 46 (1850).

Black: tegmina with reddish veins and a median transverse, narrow whitish band: wings testaceous, apical part black. Body long 25: exp. teg. 75 millims.

Reported from Silhat. The Indian Museum possesses specimens from Sikkim.

## 35. GÆANA CONSORS.

*Gæana consors*, White, Proc. Zool. Soc. 1850; Walker, List Hom. B. M. i, p. 253 (1850).

Close to *G. festiva*, but differing in the markings on the tegmina. Body long 29: exp. teg. 84 millims.

The Indian Museum possesses specimens from the Nága Hills and Samaguting in Assam. One specimen has the body above and below black without a single spot or mark except a testaceous tinge on the lower part of the face; and the markings on the tegmina are dark green.

36. *GÆANA FESTIVA.*

*Tettigonia festiva*, Fabricius, Syst. Rhyn. p. 41 (1803).

*Cicula thulassina*, Percheron, Gen. Ins. (Hém.), t. 2 (1834): Guérin, Voyage La Coquille, Ins. p. 183 (1838).

*Cicada percheronii*, Guérin, Icon. Règne Animal, p. 355 (1838).

*Gæana consobrina*, White, Proc. Zool. Soc. 1850; Walker, List Hom. B. M. i, p. 254 (1850).

*Gæana festiva*, Stål, Berl. Ent. Zeitschr. x, p. 170 (1866); Hem. Fabr. ii, p. 5 (1869).

Black: a testaceous band across the face from eye to eye and around each eye: four narrow longitudinal yellow lines on the thorax. Tegmina bluish green or greenish yellow, the radial area with a small and larger spot below, a median band, three confluent apical patches, and a broad apical limb, black: wings white or bluish, apical part black with a white or bluish spot on the disc. Body long 33: exp. teg. 80 millims.

Reported from Assam, Bengal.

The Indian Museum possesses specimens from Darjiling and Sikkim. Some of these have the tegmina green, others greenish yellow, and, in some, the wings have the basal portion and a discal spot bright testaceous not white or pale, the size and arrangement of the markings on the body and tegmina remaining exactly the same.

37. *GÆANA MACULATA.*

*Tettigonia maculata*, Fabricius, Syst. Ent. App. p. 831 (1775); Spec. Ins. ii, p. 319 (1781); Mant. Ins. ii, p. 266 (1787); Ent. Syst. iv, p. 20 (1794); Syst. Rhyn. p. 37 (1803).

*Cicula maculata*, Drury, Ill. Nat. Hist. ii, p. 69, t. 37, f. 1 (1773); Gmelin, ed. Syst. Nat. i, pt. 4, p. 2100 (1782); Olivier, Enc. Méth. v, p. 750, t. 112, f. 4 (1790); Germar in Thon's Archiv. ii, fasc. 2, p. 12 (1830); in Silbermann's Rev. Ent. ii, p. 74 (1834).

*Gæana maculata*, Am. et Serv., Hist. Nat. Ins. Hém. p. 464 (1843); Walker, List Hom. B. M. i, p. 253 (1850).

♀. Black shining: two yellow spots on vertex between the eyes, one below each eye: six on mesonotum, four in front, two behind. Tegmina black, with five spots, two basal (of which one within radial area is minute) and three larger subequal median spots, whitish yellow: a white dot in 1—3 ulnar and in all the apical areas except the last. Wings black, basal part sordidly white and a sub-apical row of five white dots. A form of the ♂ has, instead of the dots or spots in the ulnar and apical areas, broad smears of dirty white, and is also larger than the ordinary ♀. Body long 32: exp. teg. 92 millims, ♀: body long 40 exp. teg. 97 millims. , form last mentioned.

The Indian Museum possesses specimens from Sikkim, Khasiya Hills, Samaguting, and the Dhansiri Valley.

38. *GÆANA SULPHUREA.*

*Cicada sulphurea*, Hope, in Royle's Ill. Bot. Him., Introd., p. liv, t. 10, f. 2 (1839).

*Cicada pulchella*, Westwood, Arc. Ent. ii, p. 34, t. 57, f. 1. (1843).

*Gæana sulphurea*, Walker, List Hom. B. M. i, p. 254 (1850).

\*Black; head, pronotum, and mesonotum spotted sulphureous: tegmina and wings sulphureous for the basal two-thirds; apical third blackish-fuscous: tegmina with a blackish-fuscous median band: abdomen beneath and on each side at the tip, spotted yellow. Body long 38: exp. teg. 90 millims.

Reported from Nepal and N. India.

The Indian Museum possesses specimens from Sikkim and N. India.

Genus *DUNDUBIA*, Am. & Serv.

Am. et Serv., Hist. Nat. Ins. Hém. p. 470 (1843): Stål, Mem. Afric. iv. p. 5 (1866).

Head triangular: frons large, very convex, transversely sulcated, with a longitudinal groove in the middle: pronotum not amplified on the lateral margins: cheeks without a tubercle: rostrum not or barely reaching the base of the posterior coxæ: opercula long, extending beyond the middle of the venter, very often to the last segment.

This and the remaining genera of this group have been so imperfectly worked out, and the synonymy is so defective, that it is impossible for any one in this country to do more than indicate the recorded species. Walker's work here is particularly untrustworthy, and his descriptions quite unintelligible.

39. *DUNDUBIA MANNIFERA.*

*Cicada mannifera*, Linnaeus, Mus. Ad. Fried. p. 84 (1754), excluding synonymy.

*Tettigonia vaginata*, Fabricius, Mant. Ins. ii, p. 266 (1787); Ent. Syst. iv, p. 18 (1794); Syst. Rhyn., p. 35 (1803).

*Cicada vaginata*, Gmelin Ed. Syst. Nat. i, pt. 4, p. 2099 (1782); Olivier, Enc. Méth. v, p. 748 (1790); Stoll, Cig. p. 38, t. 7, f. 35 (1788).

*Cicada virescens*, Olivier, Enc. Méth. v, p. 747 (1790) t. 110, f. 2; Walker, List Hom. B. M. i, p. 64 (1850).

*Dundubia vaginata*, Am. et Serv., Hist. Nat. Ins. Hém. p. 471 (1843); Walker, List Hom. B. M. i, p. 47, 1120, (1850); J. L. S. Zool. x, p. 84 (1867).

*Dundubia mannifera*, Stål, Berl. Ent. Zeitschr. x, p. 170 (1866); Distant, J. A. S. B. xlviii, (2), p. 38 (1879); Trans. Ent. Soc. p. 634 (1881).

Body pale yellow-olive or virescent, spotless; tegmina and wings hyaline, spotless, costa of the former black or brown; opercula almost as long as the abdomen, narrowed near the base, thence oval, rounded at the tip, testaceous or pale green. ♂. Body long 43: exp. teg. 110 millims.

Reported from Morty, Sumatra, Tenasserim, Assam.

The Indian Museum possesses specimens from Java, Tenasserim, and Sikkim.

#### 40. DUNDUBIA MICRODON.

*Dundubia microdon*, Walker, List Hom. B. M. i, p. 55 (1850).

Body long, 34 : exp. teg. 88 millims. Reported from N. India.

#### 41. DUNDUBIA LATERALIS.

*Dundubia lateralis*, Walker, List Hom. B. M. i, p. 61 (1850).

Body long, 29 : exp. teg. 87 millims. Reported from Silhat.

#### 42. DUNDUBIA INTEMERATA.

*Dundubia intemerata*, Walker, J. L. S. Zool. i, p. 84 (1856).

Pale testaceous : tegmina and wings hyaline, spotless, the costa of the former tawny, veins green. Opercula acute, triangular, narrow, extending to fifth ventral segment. Body long 21 : exp. teg. 72 millims.

Reported from Singapore.

The Indian Museum possesses specimens from Tenasserim, Dhansiri-valley, Sibságar, Nága Hills, Samaguting.

#### 43. DUNDUBIA VIBRANS.

*Dundubia vibrans*, Walker, List Hom. B. M. i, p. 54 (1850) : J. L. S. Zool. x, p. 84 (1867).

Body pale tawny, wings colourless, pale tawny at the base ; apex of tegmen slightly clouded with brown. Body long 36 : exp. teg. 92 millims.

Reported from Silhat.

#### 44. DUNDUBIA NICOMACHE.

*Dundubia nicomache*, Walker, List Hom. B. M. i, p. 67 (1850).

Body long 22 : exp. teg. 85 millims. Reported from N. India.

#### 45. DUNDUBIA TIGRINA.

*Dundubia tigrina*, Walker, List Hom. B. M. i, 69 (1850).

Body long 23 : exp. teg. 69 millims. Reported from Malabar.

The Indian Museum possesses specimens from Assam ?

#### 46. DUNDUBIA MACULIPES.

*Dundubia maculipes*, Walker, List Hom. B. M. i, p. 70 (1850).

Body long 25 : exp. teg. 71 millims. Reported from N. Bengal.

## 47. DUNDUBIA SAMIA.

*Dundubia samia*, Walker, List Hom. B. M. i, p. 77 (1850).

Body long 28: exp. teg. 71 millims. Reported from N. India.

## 48. DUNDUBIA SINGULARIS.

*Dundubia singularis*, Walker, List Hom. B. M. Suppt. p. 7 (1858).

Body long 19: exp. teg. 62 millims. Reported from India.

## 49. DUNDUBIA RADHA.

*Dundubia radha*, Distant, Trans. Ent. Soc. p. 634 (1881).

Allied to *D. mannifera*, Linn., from which it differs by the much broader head, attenuated apices of the opercula, and its much larger size. In superficial appearance, it bears a strong resemblance to the genus *Cosmopsaltria*. (Distant). Body long 33: exp. teg. 124 millims.

Reported from Madras Presidency and Mussooree.

## 50. DUNDUBIA TRIPURASURA.

*Dundubia tripurasura*, Distant, Trans. Ent. Soc. p. 635 (1881).

This species is allied to *D. vibrans*, Walker, from which it structurally differs by the long and subtriangular opercula. The abdomen is also broader, the tegmina unspotted, and the sanguineous colour of the abdomen and opercula are also somewhat peculiar and distinct. (Distant). Body long 33: exp. teg. 85 millims.

Reported from Assam.

## 51. DUNDUBIA NAGARASINGNA.

*Dundubia nagarasingna*, Distant, Trans. Ent. Soc. p. 635 (1881).

Distant writes:—‘I am somewhat at a loss for a closely allied species with which to compare it, but its distinct colour and markings and shape and the length of the opercula should sufficiently distinguish it.’ Body long 39: exp. teg. 95 millims.

Reported from N. W. Burma.

## 52. DUNDUBIA IMMACULA.

*Dundubia immacula*, Walker, List Hom. B. M. i, p. 50 (1850).

Body fawn colour, wings whitish. Body long 40: exp. teg. 102 millims. Reported from Tenasserim.

Genus *MYLAMPSALTA*, Kol.

Melet. Ent. vii. p. 27 (1857).



## 53. MELAMPSALTA VARIANS.

*Cicada varians*, Germar in Silbermann's Rev. Ent. ii, p. 59 (1834).

*Dundubia varians*, Walker, List Hom. B. M. i, p. 48 (1850); iv, p. 1120 (1852): Suppt. p. 6 (1858).

*Dundubia chlorogaster*, Walker (nec Boisduval), l. c. p. 47, ♀.

*Melampsalta varians*, Stål, A. S. E. F. (4 Sér.) i. p. 619 (1862).

Reported from Silhat.

## Genus COSMOPSALTRIA, Stål.

Hem. Afric. iv, p. 5 (1866).

In Ofvers. Kong. Vet. Aka. Förh. p. 708 (1870), Stål distributes this genus amongst three subgenera:—*Platylomia* to which *C. flavula*, Guérin, belongs; *Cosmopsaltria* to which *C. spinosa*, Fabr., belongs; and *Piceropygia* to which *C. oblecta*, Fabr., belongs. *Cosmopsaltria* is closely allied to *Dundubia*; cheeks without a tubercle; rostrum reaching the base or most often the apex of the posterior coxæ; opercula long, extending beyond the middle of the venter.

## 54. COSMOPSALTRIA OBLECTA.

*Tettigonia oblecta*, Fabricius, Syst. Rhyn. p. 35 (1803).

*Cicada oblecta*, Germar, in Thon's Archiv, ii, fasc. 2, p. 5 (1830).

*Dundubia oblecta*, Walker, List Hom. B. M. i, p. 47 (1850).

*Cosmopsaltria oblecta*, Stål, Hem. Fabr. 2, p. 4 (1869).

Reported from N. India, N. Bengal, Nepál and Assam. Body long 25: exp. teg. 85 millims.

Specimens in the Indian Museum are from Sikkim and Assam.

## 55. COSMOPSALTRIA SITA.

*Cosmopsaltria sita*, Distant, Trans. Ent. Soc. p. 636 (1881).

It is difficult to separate this and the two following species from the genus *Dundubia* except by the length of the rostrum. They also resemble the 'vibrans' group of that genus. Body long 24: exp. teg. 73 millims.

Reported from S. India or Bombay. (*Distant*).

## 56. COSMOPSALTRIA DURGA.

*Cosmopsaltria durga*, Distant, Trans. Ent. Soc. p. 637 (1881).

This species in size and markings (excluding the spotted tegmina) much resembles *Dundubia tripurasura*, Distant; the less produced frontal portion of the head and the length of the rostrum, however, place it in this genus (*Distant*). Body long 33: exp. teg. 98 millims.

Reported from Assam.

## 57. COSMOPSALTRIA ABDULLA.

*Cosmopsaltria abdulla*, Distant, Trans. Ent. Soc. p. 639 (1881).

This is a large and distinct species, near *C. doryca*, Boisd., from

which it differs by its large size, more spotted tegmina, and different size and structure of the opercula. Body long 46: exp. teg. 116—122 millims.

Reported from Penang and Singapore.

#### 58. COSMOPSALTRIA OOPAGA.

*Cosmopsaltria oopaga*, Distant, Trans. Ent. Soc. p. 641 (1881).

This species is also allied to *C. doryca*, Bois., but the body is much broader, the tegmina are unspotted, and the shape of the opercula more like those of *C. abdulla*, Distant. Body long 39: exp. teg. 96 millims.

Reported from Burma.

#### 59. COSMOPSALTRIA SPINOSA.

*Tettigonia spinosa*, Fabricius, Mant. Ins. ii, p. 266 (1787); Ent. Syst. iv, p. 17 (1794); Syst. Rhyn. p. 34 (1803).

*Cicada spinosa*, Olivier, Enc. Méth. v, p. 748 (1790).

*Dundubia spinosa*, Walker, List Hom. B. M. i, p. 47 (1850).

*Cosmopsaltria spinosa*, Stål, Berl. Ent. Zeitsch. x, p. 171 (1866); Ofvers. Kong. Vet. Aka. Förh. p. 708 (1870).

Varies much in size and coloration. Tegmina towards the apex of the veins sometimes immaculate and sometimes with fuscous spots.

Reported from India.

#### 60. COSMOPSALTRIA FLAVIDA.

*Cicada flavida*, Guérin, Voyage Belanger in Ind. Orient. p. 498, t. 3, f. 1, (1834); Walker, List Hom. B. M. i, p. 118 (1850).

*Dundubia saturata*, Walker, List Hom. B. M. Suppt. p. 6 (1858).

*Cosmopsaltria flavida*, Stål, Berl. Ent. Zeitsch. x, p. 171 (1866).

Body long 45: exp. teg. 140 millims. Reported from Java and Sikkim.

#### GENUS LEPTOPSALTRIA, Stål.

Hem. Afric. iv, p. 5 (1866).

Allied to *Dundubia*, Am. et Serv.; cheeks with a tubercle near the apex; rostrum extending a little beyond the posterior coxæ; opercula short: second and third segments of the abdomen in the ♂ with a lateral tubercle.

#### 61. LEPTOPSALTRIA GUTTULARIS.

*Cicada guttularis*, Walker, List Hom. B. M. Suppt. p. 29 (1858), ♀.

*Leptopsaltria guttularis*, Stål, Hem. Ins. Philip. in Ofvers. Kong. Vet. Akad. Förh. p. 710 (1870), ♂.

Very like *L. tuberosa*, Sign., but differs in the opercula being more obtuse, apex much less obliquely truncated, exterior apical part more obtuse, less produced, ventral tubercles of the ♂ larger, black. Body long 13: exp. teg. 46 millims.

Reported from Burma.

There are several unnamed species of this genus in the Indian Museum.

### Genus POMPONIA, Stål.

Hem. Afric. iv, p. 6 (1866).

Allied to *Cosmopsaltria*: opercula short, somewhat transverse: rostrum reaching at least to the base but most often to the apex of the posterior coxæ. Stål (Ofvers. K. V.-A. Förh. p. 710, 1870) separates the subgenera *Pomponia* and *Oncotympana*.

### 62. POMPONIA URANIA.

*Dundubia urania*, Walker, List Hom. B. M. i, p. 64 (1850).

*Pomponia urania*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866).

Hind-scutcheon bright green; abdomen green. Body long 34: exp. teg. 83 millims.

Reported from Hindustan.

### 63. POMPONIA BINDUSARA.

*Pomponia bindusara*, Distant, Trans. Ent. Soc. p. 642 (1881).

This species, above, resembles *Dundubia vibrans*, Walker, and *Cosmopsaltria sita*, Distant. Many of these Indian species belonging to the genera *Dundubia*, *Cosmopsaltria*, and *Pomponia* have a common facies in colour and markings which Distant thinks is probably due to mimetic resemblance, and which, in practice, renders their identification exceedingly difficult. Body long, 30: exp. teg. 87 millims.

Reported from Tenasserim.

### 64. POMPONIA LINEARIS.

*Dundubia linearis*, Walker, List Hom. B. M. i, p. 48 (1850). Var., l. c. iv, p. 1120 (1852).

*Dundubia ramifera*, Walker, var., l. c. p. 53 (1850): J. L. S. Zool. x, p. 84 (1867).

*Dundubia cinctimanus*, Walker, List l. c. p. 49 and Suppt. p. 6 (1858): J. L. S. Zool. x, p. 84 (1867).

*Pomponia linearis*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866).

Body tawny. Body long 46: exp. teg. 118 millims.

Reported from Silhat.

The Indian Museum possesses a specimen from Assam.

### 65. POMPONIA KAMA.

*Pomponia kama*, Distant, Trans. Ent. Soc. p. 643 (1881).

Allied to *P. transversa*, Walker, but much smaller, abdomen narrower and more linear, head broader in comparison with pronotum and colour different. Body long 18: exp. teg. 66 millims.

Reported from N. India, Darjiling.

## 66. POMPONIA MADHAVA.

*Pomponia madhava*, Distant, Trans. Ent. Soc. p. 644 (1881).

Allied to *P. tigroides*, Walker, from which it differs by its being pale greenish and unicolorous, the tegmina broader, with the costal margin irregularly curved and not deflexed at the termination of the radial veins, and also in having both the second and third abdominal segments beneath rounded, produced and pointed anteriorly. Body long 22: exp. teg. 55 millims.

Reported from Assam.

## 67. POMPONIA IMPERATORIA.

*Cicada imperatoria*, Westwood, Arc. Ent. ii, p. 14, t. 51, (1843): Walker, Hist Hom. B. M. i, p. 47: J. L. S. Zool. i, p. 83 (1856): ibid. x, p. 84 (1867).

*Pomponia imperatoria*, Stål, Berl. Ent. Zeitschr. x, p. 171 (1866).

A very large species, yellow luteous, body long 88, exp. teg. 209 millims.

Reported from Nepál.

## 68. POMPONIA TIGROIDES.

*Pomponia tigroides*, Distant, J. A. S. B. xlviii (2), p. 38 (1879).

The Indian Museum possesses a specimen from Tenasserim.

## Genus EMATHIA, Stål.

Hem. Afric. iv, p. 8 (1866).

Inner ulnar area of tegmina not widened towards the apex; apical cells one and two extending equally far forward; thorax widened at the base: tympana chiefly exposed; opercula short: anterior femora spinose.

## 69. EMATHIA ÆGROTA.

*Emathia ægrota*, Stål, Berl. Ent. Zeitschr. x, p. 172 (1866).

Body long 20: exp. teg. 50 millims. Reported from Bombay.

## Genus CICADA, Linn.

Linnaeus, Syst. Nat. i, p. 704 (1766): Stål, Rio. Jan. Hem. ii, p. 19 (1862)  
Ofvers K. V. A. Förh. p. 714 (1870).

## 70. CICADA SUBTINCTA.

*Cicada subtincta*, Walker, List B. M. i, p. 147 (1850).

Body long 32: exp. teg. 105 millims. Reported from Silhat.

## 71. CICADA ANÆA.

*Cicada anæa*, Walker, l. c., p. 207 (1850).

Body long 13: exp. teg. 40 millims. Reported from N. Bengal.

72. *CICADA AURATA.*

*Cicada aurata*, Walker, l. c., p. 215 (1850).

Body long 17: exp. teg. 42 millims. Reported from Assam.

73. *CICADA SUBVITTA.*

*Cicada subvitta*, Walker, l. c., p. 222 (1850).

Body long 16: exp. teg. 38 millims. Reported from N. India.

74. *CICADA FERRUGINEA.*

*Cicada ferruginea*, Olivier, Enc. Méth. v, p. 750, t. 112, f. 1 (1790); Stoll, Cig p. 65, t. 16, f. 86 (1788); Walker, List Hom. B. M. i, p. 417 (1850).

Reported from India.

75. *CICADA XANTES.*

*Cicada xantes*, Walker, List Hom. B. M. i, p. 198 (1850).

Body, drums, and legs tawny: wings colourless, veins yellow. Body long 17: exp. teg. 48 millims.

Reported from N. India.

76. *CICADA MACULICOLLIS.*

\**Cicada maculicollis*, Guérin, Voyage La Coquille, Zool., p. 183 (1830); Walker, List Hom. B. M. Suppl., p. 28 (1858).

Body long 24: exp. teg. 65 millims. Reported from Bengal.

Genus *CRYPTOTYMPANA*, Stål.

A. S. E. F. (4 Sér.), i, p. 613 (1862).—Hem. Afric. iv, p. 6 (1866).

77. *CRYPTOTYMPANA RECTA.*

*Fidicina recta*, Walker, List Hom. B. M. i, p. 79 (1850) ♀.

*Cryptotympana recta*, Distant, J. A. S. B. xlviii (2), p. 40, t. ii, f. 4 (1879), ♂.

Body long 32: exp. teg. 95 millims. Reported from Silhat and Tenasserim.

The Indian Museum possesses a specimen from Tenasserim.

78. *CRYPTOTYMPANA VICINA.*

\**Cicada vicina*, Signoret, Rev. Mag. Zool., p. 410, t. 10, f. 4 (1849).

*Fidicina vicina*, Walker, List Hom. B. M. i, p. 90 (1850).

*Cryptotympana vicina*, Stål, A. S. E. F. (4 Sér.) i, p. 613 (1862).

Reported from Silhat.

The Indian Museum possesses specimens from the Bhutan Duars.

## 79. CRYPTOTYMPANA IMMACULATA.

*Cicada immaculata*, Olivier, Enc. Méth. v, p. 749, t. 112, f. 7 (1790) : Stoll, Cig.<sup>2</sup> p. 40, t. viii, f. 39 (1788) : Signoret, Rev. Mag. Zool. p. 410 (1849).

*Fidicina immaculata*, Walker, List Hom. B. M. i, p. 90 (1850) ; iv, p. 1121 (1852).

*Cryptotympana immaculata*, Stål, A. S. E. F. 4 Sér. i. p. 613 (1862).

Reported from N. Bengal.

## 80. CRYPTOTYMPANA INTERMEDIA.

*Cicada intermedia*, Signoret, Mag. Rev. Zool. p. 406, t. 10, f. 2 (1849).

*Fidicina intermedia*, Walker, List Hom. B. M. i, p. 90 (1850).

*Cryptotympana intermedia*, Stål, A. S. E. F. 4 Sér. i. p. 613 (1862).

Abdomen reddish yellow with a blackish band on each segment : allied to *C. atrata*, Fabr.

Reported from Tenasserim.

## Genus FIDICINA, Amyot &amp; Serville.

Amyot et Serville, Hist. Nat. Ins. Hém. p. 472 (1843) : Stål, Rio. Jan. Hom. ii, p. 18 (1862) ; Ann. Soc. Ent. Fr. (4 sér) i, p. 614 (1861) ; Hom. Afric. iv, p. 7 (1866) ; Distant, Biol. Cen. Amer. p. 16 (1881).

## 81. FIDICINA OPERCULATA.

*Cicada operculata*, Carreno.

*Fidicina operculata*, Walker, List Hom. B. M. i, p. 90 (1850).

Reported from N. India.

The Indian Museum possesses a specimen.

## 82. FIDICINA CORVUS.

*Fidicina corvus*, Walker, List Hom. B. M. i, p. 86 (1850).

Reported from Silhat. Body long .29 : exp. teg. 113 millims.

The Indian Museum possesses a specimen of the ♀ from Silhat.

## Genus TIBICEN, Latreille.

Latreille, Fam. Nat. p. 426 (1825) : Stål, Hom. Afric. iv, p. 25 (1866).

## 83. TIBICEN AURENGZEBE.

*Tibicen aurengzebe*, Distant, Trans. Ent. Soc., p. 646 (1881).

Body long 16 : exp. teg. 48 millims. Reported from Bombay Presidency.

## 84. TIBICEN APICALIS.

*Cicada apicalis*, Germar in Thon's Archiv, ii, fasc. 2, p. 8 (1830) ; in Silbermann's Rev. Ent. ii, p. 63 (1834) ; Walker, List Hom. B. M. i, p. 161 (1850).

*Tibicen apicalis*, Stål, A. S. E. F. 4 Sér., i, p. 618 (1862).

Body long 18 : exp. teg. 48 millims., ♀. Reported from N. India.

The Indian Museum possesses a specimen from Calcutta.

Genus *MOGANNIA*, Amyot & Serville.

\* Amyot et Serville, Hist. Nat. Ins. Hém., p. 467 (1843): Stål, Hem. Afric. iv. p. 5 (1866).

85. *MOGANNIA ILLUSTRATA*.

*Mogannia illustrata*, Am. et Serv., Hist. Nat. Ins. Hém. p. 467, t. 9. f. 4 (1843); Walker, List Hom. B. M. i, p. 248 (1850).

Body uniform ferruginous brown: basal half of tegmina and a small semicircular patch on the tips, transparent yellow, a brown transverse band across the middle. Body long, 12 millims.

Reported from N. India.

86. *MOGANNIA RECTA*.

*Mogannia recta*, Walker, List Hom. B. M. Suppt. p. 39 (1858).

Abdomen with a red band on the posterior border of each segment. Body long, 12 millims.

Reported from Hindustan.

87. *MOGANNIA OBLIQUA*.

*Mogannia obliqua*, Walker, List Hom. B. M. Suppt. p. 39 (1858).

♀. green mostly reddish beneath: abdomen reddish with a spot on each side near the base. Pronotum and mesonotum with some testaceous marks. Body long, 14: exp. teg. 41 millims.

Reported from Hindustan.

88. *MOGANNIA VENUSTISSIMA*.

*Mogannia venustissima*, Stål, Ofvers. Kong. Vet. Aka. Förh. p. 154 (1865).

Cerulean or metallic black. Tegmina with the veins at the base pale sanguineous, before the middle black; thence sordid straw-colour: wings with the veins at the base sanguineous and thence piceous. Body long, 16: exp. teg. 37—41 millims.

Reported from E. India.

89. *MOGANNIA FUNEBRIS*.

*Mogannia funebris*, Stål, Ofvers. Kong. Vet. Akt. Förh. p. 155 (1865).

Aeneous black. Tegmina, before the middle, black with the basal areola and a band towards the apex of the black part sordid lutescent. ♀ Body long, 19: exp. teg. 46 millims.

Reported from Silhat.

90. *MOGANNIA INDICANS*.

*Mogannia indicans*, Walker, List Hom. B. M. i p. 249 (1850).

♂ bright or dark red, ♀ black. Tegmina with a broad basal brown band, veins yellow. Body long 12—16: exp. teg. 35—40 millims.

Reported from China.

The Indian Museum possesses specimens from Sikkim.

91. *MOGANNIA LOCUSTA*.

*Cephaloxys locusta*, Walker, List Hom. B. M. i, p. 236 (1850).

• Body ferruginous beneath and abdomen pale tawny. Body long 50 :  
exp. teg. 85 millims.

Reported from E. India.

• 92. *MOGANNIA LACTEIPENNIS*.

*Cephaloxys lacteipennis*, Walker, List Hom. B. M. i, p. 237 (1850).

Body luteous : abdomen black with the hind borders of the segments  
tawny : tegmina and flaps white, opaque, luteous at the base. Body long.  
36 : exp. teg. 97 millims (?).

Reported from N. India.

93. *MOGANNIA QUADRIMACULA*.

*Cephaloxys quadrimacula*, Walker, List Hom. B. M. p. 238 (1850).

Body bright tawny : hind margins of abdomen having the borders  
of the segments with slender interrupted reddish bands, a broad pale  
tawny band near the tip and beneath, piceous. Body long 30 : exp. teg.  
53 millims.

Reported from N. India.

94. *M. TERPSICHOE*.

*Cephaloxys terpsichore*, Walker, List Hom. B. M. p. 239 (1850).

Body apple-green : abdomen with two last segments pitchy above :  
tegmina colourless, tinged with brown towards the tips, costa green.  
Body long 25 : exp. teg. 74 millims.

Reported from E. India.

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CORRECTION AND ADDITION.

Page 213, 4 lines from top of page, for "*NICOBARICA*," read "*DISTINCTA*," the  
former of these names being præoccupied ; and, between the 10th  
and 11th lines from bottom of page, insert

" 5\* *PLATYPLEURA NICOBARICA*."

*Platypleura nicobarica*, Butler, Ann. & Mag. Nat. Hist. April, 1877.

Reported from the Nicobars."



X.—*List of the Lepidopterous Insects collected in Cachar, by Mr. J. WOOD-MASON, Part I,—HETEROCERA.—By F. MOORE, F. Z. S., A. L. S. Communicated by the NATURAL HISTORY SECRETARY.*

[Received August 26th ;—Read December 3rd, 1884.]

#### SPHINGES.

1. *MACROGLOSSA BELIS*, Cram., Pap. Exot. i. pl. 94, fig. C.
2. *MACROGLOSSA LUTEATA*, Butler, P. Z. S. 1875, p. 241, pl. 37, fig. 5.
3. *MACROGLOSSA GILIA*, H. Schæff., Samml. Exot. Schmett. pl. 23, fig. 107.
4. *MACROGLOSSA GYRANS*, Walk., Catal. Lep. Het. Brit. Mus. viii, p. 91.
5. *LOPHURA PUSILLA*, Butler, P. Z. S. 1875, p. 244.
6. *HÆMARIS HYLAS*, Linn. (Cram., Pap. Exot. pl. 148, fig. B.).
7. *CALYMNIA PANOPUS*, Cram., Pap. Exot. pl. 224, fig. A, B.

#### BOMBYCES.

8. *MELITTIA EURYTION*, Westw., Cab. Orient. Ent. pl. 39, fig. 5.
9. *EUSEMIA COMMUNIS*, Butler, Ann & Mag. Nat. Hist. 1875, p. 140, pl. 13, fig. 1.
10. *EUSEMIA BELLATRIX*, Westw., Cab. Orient. Ent. pl. 33, fig. 2.
11. *NYCTALEMON ZAMPA*, Butler, Ent. Monthly Mag. v. p. 273.
12. *SYNTOMIS ATKINSONI*, Moore, P. Z. S. 1871, p. 245, pl. 18, fig. 2.
13. *EUCHROMIA POLYMENA*, Linn. (Cram., Pap. Exot. pl. 31, fig. D).
14. *MILIONIA ZONEA*, Moore, P. Z. S. 1872, p. 569.
15. *NYCTEMERA LACTICINIA*, Cram., Pap. Exot. pl. 128, fig. E.
16. *PITASILA VARIANS*, Walker (Butler, Types Lep. Het. B. M. v. pl. 88, fig. 4).
- \*17. *TRYPHÆROMERA PLAGIFERA*, Walk. (Butler, l. c., pl. 88, fig. 3).
18. *EUSCHEMA MILITARIS*, Linn. (Cram., Pap. Exot. pl. 29, fig. B).
19. *HISTIA PAPILIONARIA*, Guérin, Mag. de Zool. 1831, p. 12.
20. *CYCLOSLIA PAPILIONARIS*, Drury, Exot. Ins. pl. 11, fig. 4.
21. *CYCLOSLIA PANTHONA*, Cram., Pap. Exot. pl. 322, fig. C.
22. *CHALCOSIA ARGENTATA*, Moore, Desc. Lep. Coll. Atkinson, p. 17.
23. *PIDORUS GLAUCOPIS*, Drury, Exot. Ins. pl. 6, fig. 4.
24. *HETERUSIA MAGNIFICA*, Butler, Trans. Ent. Soc. 1879, p. 5.
25. *HETERUSIA EDOCLA*, Dbleday, Zoologist, ii, p. 469.

26.\* *DEVANICA BICOLOR*, Moore, n. sp.

Female: forewing black, crossed by a yellow outwardly oblique medial band; veins indistinctly lined with blue: hindwing yellow, with a black marginal band, which is broad and truncated at the apical end and very narrow at anal end; base of wing also slightly black. Body, legs, and antennæ bluish-black. Expanse  $1\frac{1}{2}$  inch.

This species is nearest allied to *D. risa* (*Eterusia risa*, Dbleday).

27. *PINTIA FERREA*, Walk. (Butler, Types Lep. Het. B. M. pl. 83, fig. 7).28. *TRYPANOPHORA HUMERALIS*, Walk., Catal. Lep. Het. B. M. vii, p. 1593.29. *HYPSA ALCIPHREDON*, Cram., Pap. Exot. pl. 133, fig. E.\*30. *HYPSA PLAGINOTA*, Butler, Types Lep. Het. B. M. pl. 87, fig. 7.31. *HYPSA HELICONIA*, Linn. (Walk., Catal. Lep. Het. B. M. ii, p. 452).32. *HYPSA CLAVATA*, Butler, Trans. Ent. Soc. 1875, p. 317.33. *HYPSA MARMOREA*, Walk., Catal. Lep. Het. B. M. p. 1674.34. *PHILONA INOPS*, Walk. (Butler, Types Lep. Het. B. M. pl. 87, fig. 6).35. *BIZONE BIANCA*, Walk., Catal. Lep. Het. B. M. vii, p. 1684.36. *BARSINE GRATIOSA*, Guérin, Delessert's Voy. pl. 26, fig. 1.37. *BARSINE CONJUNCTANA*, Walk. (*tessellata*, Butler, Types Lep. Het. B. M. pl. 86, f. 12).38. *ALOPE OCELLIFERA*, Walk., Catal. Lep. Het. B. M. iii, p. 520.39. *ALOA SANGUINOLENTA*, Fabr., Ent. Syst. iii, 1, p. 473.40. *CREATONOTUS DIMINUTA*, Walk. (Butler, Types Lep. Het. B. M. pl. 85, fig. 5).41. *RHODOGASTRIA ASTREA*, Drury, Ins. ii, pl. 28, fig. 4.42. *ORGYIA ALBIFASCIA*, Walk., Catal. Lep. Het. B. M. Suppl. p. 325.43. *ARTAXA SUBFASCIATA*, Walk., l. c. Suppl. p. 332.44. *REDOA SUBMARGINATA*, Walk. (Butler, Types Lep. Het. B. M. pl. 89, fig. 3).45. *PERINA BASALIS*, Walk., Catal. Lep. Het. B. M. iv, p. 966.46. *NUMENES INSIGNIS*, Moore, Catal. Lep. F. I. C. ii, pl. 10, fig. 6.47. *LYMANTRIA OBSOLETA*, Walk., Catal. Lep. Het. B. M. iv, p. 880.48. *TRABALA VISHNU*, Lefebvre, Zool. Journ. iii, p. 207.49. *DREATA TESTACEA*, Walk., Catal. Lep. Het. B. M. iv, p. 905.50. *CRICULA TRIFENESTRATA*, Helfer, Journ. As. Soc. Beng. 1873, p. 45.51. *APHENDALA DIVARICATA*, Moore, n. sp.

Female. Upperside pale, purplish brownish ochreous: forewing with a slender dark ochreous-brown band curving upward from poste-

rior margin at one-third from the base to one-third before the apex, and from which a straight erect similar band extends from its costal end to the posterior angle. Body dark ochreous-brown. Expanse  $1\frac{3}{4}$  inch. Taken at Silcuri.

52. *NATADA RUGOSA*, Walk. Catal. Lep. Het. B. M. v. p. 1109.

[53. *ZEUZERA*, sp. The larvæ, pupæ, and perfect insects observed by J. Wood-Mason. The 'borer' of tea-planters.].

#### NOCTUES.

54. *PRODENIA CILIGERA*, Guén., Noct. i, p. 164.

55. *AMYNIA SELENAMPHA*, Guén., Noct. i, p. 406.

56. *ALAMIS UMBRINA*, Guén., Noct. iii, p. 4.

57. *XANTHODES TRANSVERSA*, Guén., Noct. ii, p. 211.

58. *VARNIA IGNITA*, Walk., Catal. Lep. Het. B. M. xxxiii, p. 825.

59. *ANOPHIA OLIVESCENS*, Guén., Noct. iii, p. 48.

60. *ATHYRMA*, sp. ?

61. *CALESIA HÆMORRHODA*, Guén., Noct. iii, p. 258.

62. *REMIGIA FRUGALIS*, Fabr. (Walker, Catal. Lep. Het. B. M. xiv, p. 1507).

63. *REMIGIA ARCHESIA*, Cram., Pap. Exot. pl. 273, fig. F. G.

64. *CALLYNA JAGUARIA*, Walk., Catal. Lep. Het. B. M. xiii, p. 1809.

65. *SERICEA SUBSTRUENS*, Walk., l. c. xiv, p. 1276.

66. *LYGNIODES HYPOLEUCA*, Guén., Noct. iii, p. 125.

67. *ARGIVA HIEROGLYPHICA*, Drury, Exot. Ins. ii, pl. 2, fig. 1.

68. *NYCTIBAO CREPUSCULARIS*, Cram. (Walk., Catal. Lep. Het. B. M. xiv, p. 1304).

69. *NYCTIBAO OBLITERANS*, Walk., l. c. xiv, p. 1307.

70. *HULODES CARANEA*, Cram., Pap. Exot. pl. 269, fig. E. F.

71. *LAGOPTERA HONESTA*, Hubn. (Walk. Catal. Lep. Het. B. M. xiv, p. 1352).

\*72. *OPHIDERES SALAMINIA*, Cram., Pap. Exot. pl. 174, fig. A.

73. *OPHIDERES FULLONICA*,

74. *SPIRAMA COHÆRENS*, Walk., Catal. Lep. Het. B. M. xiv, p. 1321.

[75. *EUMETA CRAMERI*. The larvæ observed by J. Wood-Mason. The 'leaf-insect' of planters.]

[76. *EUMETA*, sp. The larvæ observed by J. Wood-Mason. The 'stick-insect' of planters.]

#### GEOMETRES.

77. *LAGYRA TALACA*, Walk., Catal. Lep. Het. B. M. xx, p. 59.

78. *URAPTERYX CROCOPTERATA*, Kollar, Hügel's Kasch. ix, p. 483.

79. • BUZURA MULTIPUNCTARIA, Walk., Catal. Lep. Het. B. M. xxi, p. 1531.
80. • ELPHOS SCOLOPAICA, Drury, Exot. Ins. ii, pl. 22, fig. 1.
81. • MACARIA NORA, Walk., Catal. Lep. Het. B. M. xxiii, p. 934.
82. NAXA TEXTILIS, Walk., l. c. vii, p. 1743.
- 83. MICRONIA CASEATA, Guén., Phal. ii, p. 27.
84. MICRONIA ACULEATA, Guén., l. c. ii, pl. 13, fig. 8.
85. ARGYRIS OCELLATA, H. Sch. (Walk., Catal. Lep. Het. B. M. xxii, p. 807.
86. ACIDALIA, sp. ?
87. ABRAXAS MARTARIA, Guén., Phal. ii, p. 205.

## PYRALES.

88. ASTURA PUNCTIFERRALIS, Guén., Delt. et Pyral. p. 320.
89. EUGLYPHIS PROCOPIALIS, Cramé, Pap. Exot. pl. 368, fig. E.

## CRAMBICES.

90. APURIMA XANTHOGASTRELLA, Walk., Catal. Lep. Het. B. M. xxvii, p. 194.

## TINEINES. •

- \*91. NOSYMNA REPLETELLA, Walk., Catal. Lep. Het. B. M. xxix, p. 831.
92. SAGORA RUTILELLA, Walk., Characters of Und. Lep. Het. p. 101 (1869).

[The insects before whose names an asterisk (\*) is prefixed were captured on Nemotha, a peak of the North Cachar Hills about 3300 feet high. All the rest were taken at Silcuri, Borakhai, Silduby, Dharmkhal, Durgakuna, Doarbun, Irangmara, Doloo, Subong, and other tea-gardens in the plains. The only species of any interest to tea-planters are the *Zeuzera* and the two case-bearers belonging to the genus *Eumeta*, descriptions of which will be published hereafter elsewhere. J. W.-M.]

**XI.—Revised Synopsis of the Species of Chœradodis, a remarkable Genus of Mantodea common to India and Tropical America.—By J. WOOD-MASON, Officiating Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College, Calcutta.**

(With 15 Woodcuts.)

Since the former version of this Synopsis was published, some additional material has fallen into my hands, by the aid of which I have been enabled to establish the existence of two distinct Indian species, and to identify with certainty a larva which I had previously assigned with hesitation to *Ch. rhombicollis*.

Two Indian species have been described, one by Fabricius under the name of *Mantis cancellata*, and the other by De Saussure as *Ch. squilla* from a perfect male insect and a larva. The recent discovery of the true female of the latter proves that the insects I had previously considered to be females and abnormal males of it represent a different species, to which I have the less hesitation in applying the Fabrician name that Prof. Westwood has named a female from Saugor in the Oxford Museum *Ch. cancellata*.

De Saussure has described and figured one of the remarkable larvæ of the genus—that of his *Ch. squilla*—, and pointed out the close resemblance it bears to that of an American species; De Borre has recently figured a larva of *Ch. rhombicollis* which is nearly intermediate in age between my figures 3 and 4; a larva of *Ch. rhomboidea* is preserved in the British Museum; and I give figures of the larvæ of three additional species and also of an earlier stage of *Ch. squilla*; so that, counting the larva of *Ch. strumaria* figured by Mérian, larvæ of no less than 7 out of the 9 species recognised by me are now known.

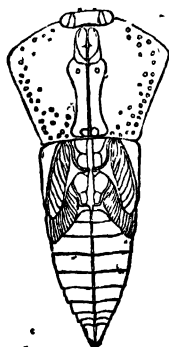


Fig. 1.

*Chœradodis cancellata.*  
♀ nymph.

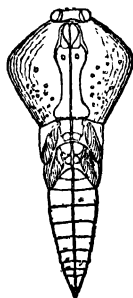


Fig. 2.

*Ch. brunneri.*  
♂ nymph.

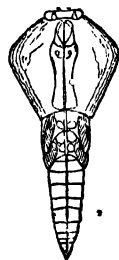


Fig. 3.

*Ch. servillei.*  
♂ nymph.

Fig. 4.

*Ch. squilla.*  
♀ nymph.

The close similarity of these larvæ to one another furnishes a remarkable confirmation of the view that the adults are congeneric.

Genus CHÆRADODIS, Serville.

*A. Fore femora without a black blotch on the inner side.*

1. CHÆRADODIS STRUMARIA.

Madame Mérian, *Ins. de Surinam*, 1726, tab. 27, ♀ et nymph.

Roosel von Rosenhof, *Der monatlich-herausgegebene Insecten Belustigung*, 2ter Theil, 1749, Locust tab. iii, fig. 1 et 2, ♀ et nymph (copied from Mérian).

*Mantis strumaria*, Linn., *Syst. Nat.* Ins. l. i, pt. ii, 1767, p. 691, no. 13, ♀.

——— *Fabr.*, *Ent. Syst.* ii, 1793, p. 18, no. 21, ♀.

——— *cancellata*, Stoll, *Spectres et Mant.* pl. xi, fig. 42, ♀ (non Fabr.).

*Chæradodis cancellata*, Serville, *Hist. nat. des Orthopt.* 1839, p. 206, ♀ (non Fabr.).

——— *cancellata*, Saussure, *Mant. Americ.* p. 19, ♂, ♀

——— *strumaria*, Wood-Mason, *J. A. S. B.* xlix, pt. ii, p. 82, 1880, ♀.

Madame Mérian was the first to figure a species of this genus. Her figures were named and described by Linnæus, whose description applies to the perfect female insect, his name having obviously been suggested by a fanciful resemblance of the swellings on the sides of the pronotum in the supposed nymph to series of scrofulous tumours (*struma*).

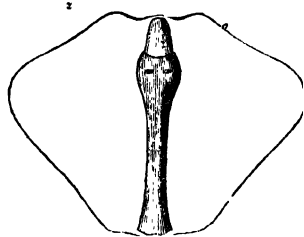


Fig 5, ♀.

The accompanying outline drawing of the pronotum of a specimen when superposed upon the same part of Mérian's figure, accurately coincides therewith.

Stoll's figure 42 without doubt represents a specimen of the same species.

HAB Cayenne (♀, *Serville*) ; Surinam (♀, *Mérian*, *Stoll* ; ♂ ♀, *De Saussure*).

*B. Fore femora with a black blotch on the inner side.*

(a.) *The blotch on the lower half of the joint (American).*

In the females of the following two species, the posterior angles of the pronotal expansions are broadly rounded and are not produced backwards beyond the level of the hinder end of the primitive pronotum.

2. *CHÆRADODIS RHOMBICOLLIS.*

*Mantis rhombicollis*, Latr. in Voy. de Humb., Zool., Ins. p. 103, pl. 39, figs. 2, 3, ♂.

*Chæradodis peruviana*, Serville, Hist. nat. des Orthopt. 1839, p. 207, ♂.

——— *strumaria*, Stål, Syst. Mant., 1877, p. 15, ♂ ♀.

——— *rhombicollis*, Wood-Mason, l. c. p. 82 ♂ ♀.—Do Borre, Liste des Mant. Mus. Roy. de Belg. 1883, p. 5; et Comptes-rendus Soc. Ent. Belg. Nov. 1883, ♀ et nymph fig.

The blotch commences, in both sexes, near the base of the femur, extends through the unguis groove nearly to the middle of the joint, and is there succeeded by a marginal row of black points in contact with the bases of alternate spines.

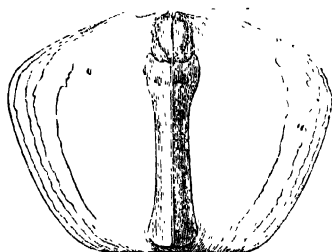


Fig. 7, ♀.

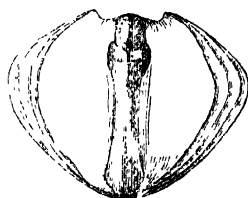


Fig. 6, ♂.

HAB. ♂ ♀, Guayaquil, in the collection of the British Museum; New Granada (♂ ♀, Stål); ♀ et nymph, Ecuador, in Mus. Roy. Belg.

3. *CHÆRADODIS SERVILLÆ.*

Wood-Mason, l. c. p. 83, ♀ et nymph.

♀. Closely allied to the preceding, from which it differs in having the marginal field of the tegmina proportionately narrower, and in the smaller size, as well as in the different shape, of the femoral blotch, which

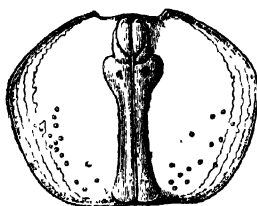


Fig. 8, ♀.

is small and oval, commences just beyond the unguis groove, and is followed by a marginal row of small black points.

HAB. 2 ♀, Cache, Costa Rica, in the collection of Messrs. Godman and Salvin and of the Indian Museum; nymph (Fig. 3), Chiriqui, in the collection of the Indian Museum, Calcutta.

## 4. CHÆRADODIS BRUNNERI.

Wood-Mason, J. A. S. B., 1882, xli, p. 21, ♀ et nymph.

♀. Closely allied to *Ch. rhombicollis*, Latr., and *Ch. Servillei*, W.-M., differing from both in the size, shape, and position of the femoral blotch, which is nearly thrice as long as broad, extends rather further in front of the unguis groove than it does behind it, and is followed by four black puncta arranged along the lower margin of the joint at the bases of alternate spines), and in having the posterior margin of the pronotum slight-

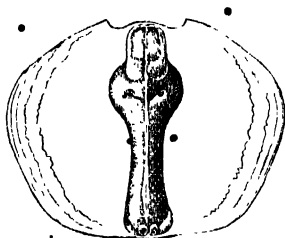


Fig. 9, ♀.

ly convex instead of concave, from the former in its much narrower and from the latter in its rather broader tegmina; and from the latter in the upper margin of its fore femora being coarsely granulated, and sinuous instead of straight, in which latter respect it approaches the former.

HAB. ♀ and nymph (Fig. 2), Santa Fé de Bogotá, New Granada, in coll. Ind. Mus. Calcutta.

In the females of the next two species, and, in all probability, in those of *Ch. rhomboidea* also, the posterior angles of the pronotal lamellæ are rounded-angulate and produced backwards, so that the hinder end of the primitive pronotum projects in the bottom of an angular emargination.

## 5. CHÆRADODIS LATICOLLIS.

*Chœradodis laticollis*, Serville, Revue, p. 24: Hist. nat. des Orthopt. 1839, p. 208, pl. iv, fig. 2, ♀.

————— Saussure, Mantes Americ. p. 20, ♀.

————— strumarum, Id., ibid. p. 18, ♂.

————— laticollis, Stål, Syst. Mant. 1877, 17, ♀.

————— Wood-Mason, J. A. S. B. 1889, vol. xlix, pt. ii, p. 83, ♂ ♀.

The blotch is situated, in both sexes, just beyond the unguis groove, is oblong-rhomboidal in shape, and is followed by two black points on the bases of alternate spines; there is a fuscous speck at the end of the stig-



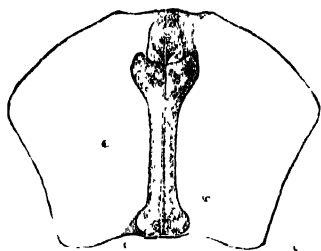


Fig. 11, ♀.

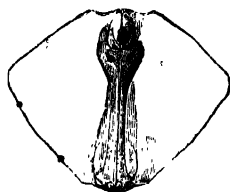


Fig. 10, ♂.

matal spot of the tegmina; and the antero-lateral margins of the pronotal lamellæ are arcuate or convex, especially in the female.

HAB. 5 ♂, 5 ♀, Ecuador, in the collection of the Indian Museum, Calcutta; Peru (♀, Stål); Cayenne (♀, *Serville et Stål*); Surinam (♂, *Saussure*).

#### 6. CHÆRADODIS STÅLI.

Wood-Mason, l. c. p. 83, ♂ ♀.

Differs from the preceding in the shape of the blotch (which is pointed at both ends and commences in the ungual groove, and on either side of which the femur is pale luteous-yellow instead of being clouded with fuscous); in being without a fuscous speck at the distal end of the

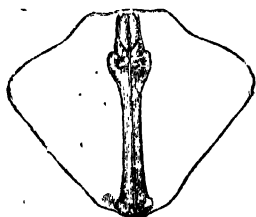


Fig. 13, ♂

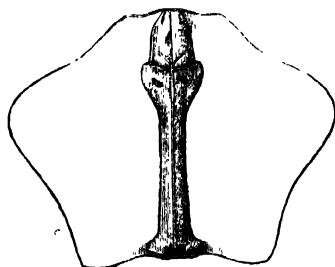


Fig. 12, ♀.

stigma; in its shorter and differently shaped facial shield; and in having the antero-lateral margins sinuous-concave and the lateral angles of the pronotal expansions more broadly rounded off.

HAB. 1 ♂, 4 ♀, Ecuador, in the Museums of Calcutta and Oxford.

#### 7. CHÆRADODIS RHOMBOIDEA.

*Mantis rhomboidea*, Stoll, *Spectres et Mantos*, pl. xi, fig. 45, ♂.

*Chæradodis rhomboidea*, Wood-Mason, l. c. p. 84, ♂.

A male insect from Pará, in the British Museum, agrees neither with *Saussure's* description (*loc. supra cit.* p. 18), nor with any of the speci-

mens in the Indian Museum; it more nearly approaches Stoll's figure, agreeing therewith in the points in which it differs from the former.

The blotch commences in the ungual groove, thence extending as far along the femur as in the preceding four species, but it is not followed by a marginal row of black points. The pronotal lamellæ have no posterior angles, their postero-lateral margins dwindling away to nothing posteriorly.

HAB. ♂, Pará, in the collection of the British Museum. A nymph, from Ega, in the same collection, probably also belongs to this species.

This species is nearest allied to *Ch. laticollis*.

(β.) *The blotch on the upper half of the joint* (Indian).

#### 8. CHÆRADODIS CANCELLATA.

*Mantis cancellata*, Fabr., Ent. Syst. ii, 1793, p. 18.

*Chæradodis squilla*, Lucas, Ann. Ent. Soc. Fr. 5 sér. ii, 1872, p. 32, ♀.

————— Wood-Mason, l. c. p. 48 (*ex parte*).

Pronotum dissimilar in the sexes, being much less dilated in the male than in the female; its antero-lateral and postero-lateral margins not forming an angle at their junction in the female.

Femoral blotch narrower, confined to the foliaceous crest of the joint, and bordered below by a band of enamel-like bright emerald-green.

In the shape and extent of the pronotal expansions, the male of this species much resembles the same sex of *Chæradodis rhomboidea*, differing, however, strikingly therefrom in its much shorter pronotum. The female approaches and differs from those of *Chæradodis rhombicollis* and its allies in the same respects.

HAB. India (*Fabricius*) generally, from Ceylon, through Madras and Central India (♀ in coll. Hop. Oxon.), to the banks of the Killing River on the N. E. Frontier (nymph [Fig. 1] in coll. Ind. Mus. Calc.)

Obs. A specimen of this species in the British Museum is erroneously labelled "Brazil."

#### 9. CHÆRADODIS SQUILLA.

*Chæradodis squilla*, Saussure, Mém. Orthopt. t. i, 3me fasc. p. 161, pl. iv, fig. 3, 3a, ♂ et nymph.

♀ ———— Lucas, Ann. Entom. Soc. Fr. 5 sér. t. ii, 1872, p. 32, ♀.

————— Wood-Mason, l. c. p. 81 (*ex parte*).

Pronotum similar in the sexes, its postero-lateral forming with its antero-lateral margin a distinct angle in both; that of the male differing from that of the female only in being rather less expanded, and consequently less convex, postero-laterally.

Femoral blotch broader, extending on to the primitive femur up to the inner end of the unequal groove and not bordered with green.

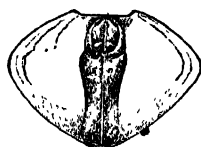


Fig. 14, ♂.

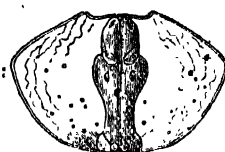


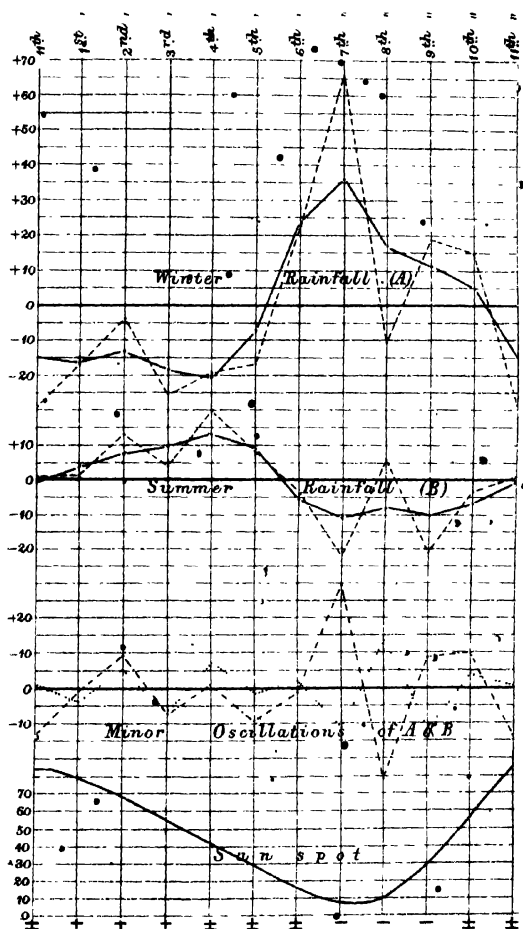
Fig. 15 ♀.

It is much more probable that the insect obtained by M. Jansen in the neighbourhood of Madras and described by Lucas as the opposite sex of De Saussure's species is a female of the preceding than of this species.

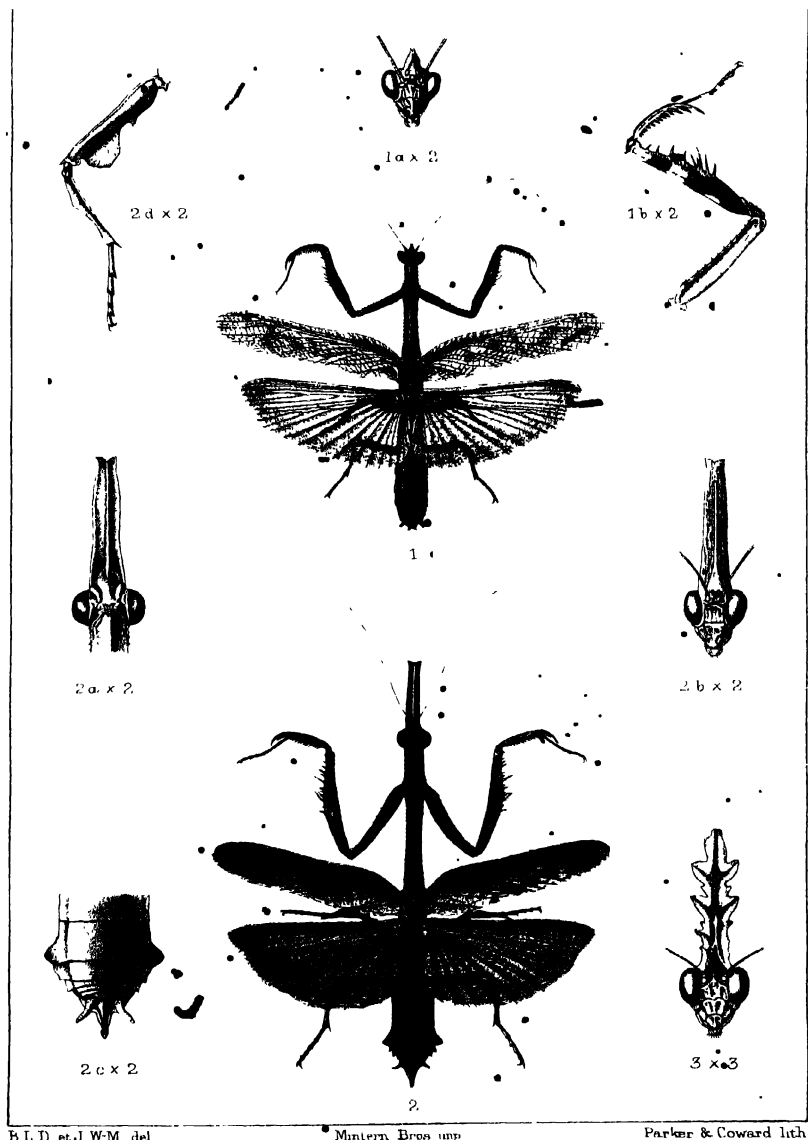
• HAB. Ceylon, ♂ et nymph in Geneva Museum, ♂ ♀ and larvæ in Museums of Calcutta and Colombo.

I am indebted to the courtesy and liberality of the Trustees of the Colombo Museum for perfect insects and nymphs, and to Mr. F. M. Mackwood for a nymph of this species.

In Fig. 14, the left lateral angle has been much too rounded off by the engraver; it should be like the right.







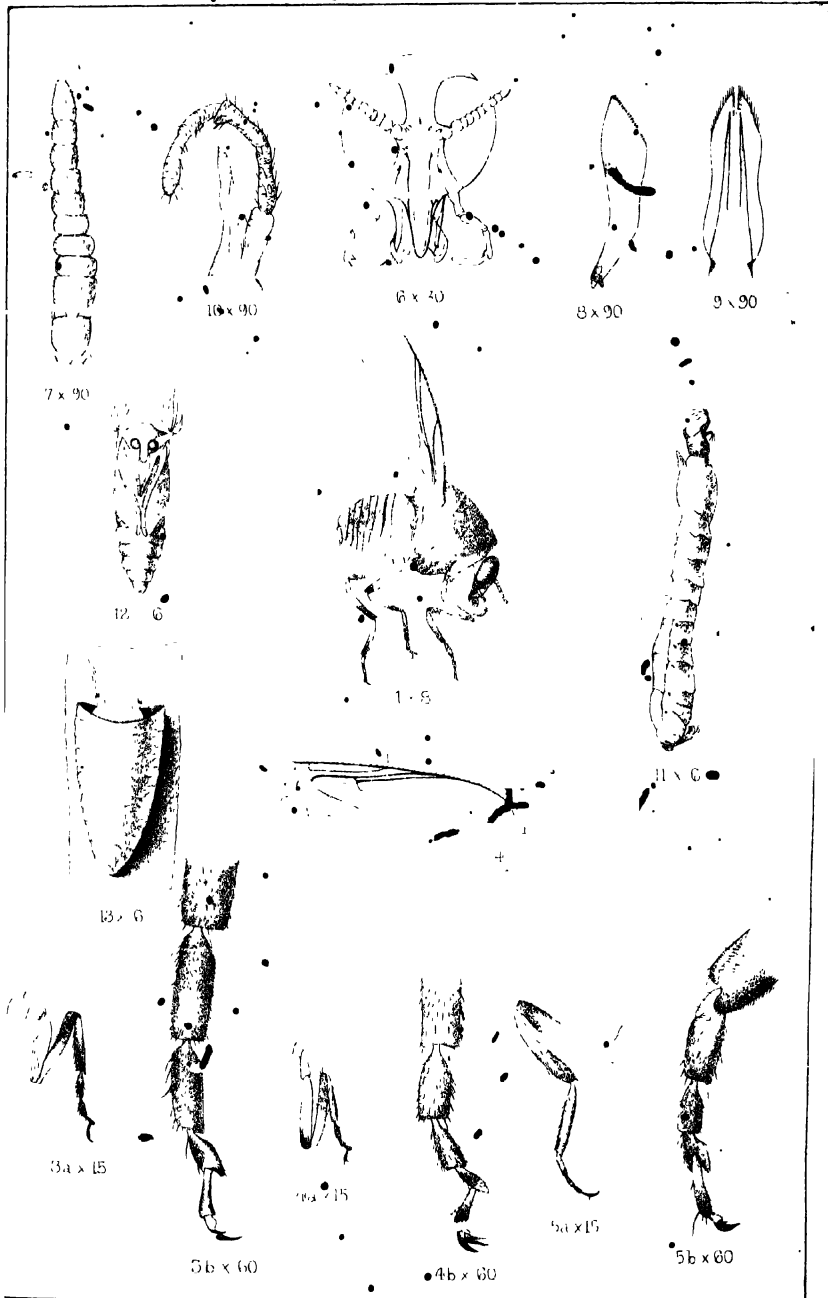
B L D et J W-M del

Mintern Bros imp

Parker & Coward lith

1-2. *Phyllothelys westwoodi*, ♂ ♀.  
3. *Phyllothelys paradoxum*, ♂ nymph.





Min. ent. Press imp.

Parker & Coward lith.

*SIMULIUM INDICUM*









